

# **STIC Search Report**

**EIC 1700**

**STIC Database Tracking Number: 208700**

**TO: Michael Bernshteyn**  
**Location: Remsen 10a34**  
**Art Unit : 1713**  
**November 29, 2006**  
**Phone: 571-272-2411**  
**Serial Number: 10 / 530965**

**From: Jan Delaval**  
**Location: EIC 1700**  
**Remsen 4a30**  
**Phone: 571-272-2504**  
  
**jan.delaval@uspto.gov**

## **Search Notes**

Access DB# 208700

# SEARCH REQUEST FORM

Scientific and Technical Information Center

Requester's Full Name: MICHAEL BERNSTEIN Examiner #: 81575 Date: 11/28/06  
Art Unit: 1713 Phone Number 30 272-3411 Serial Number: 10/530,465  
Mail Box and Bldg/Room Location: Room 10A34 Results Format Preferred (circle): PAPER DISK E-MAIL

If more than one search is submitted, please prioritize searches in order of need.  
\*\*\*\*\*

Please provide a detailed statement of the search topic, and describe as specifically as possible the subject matter to be searched. Include the elected species or structures, keywords, synonyms, acronyms, and registry numbers, and combine with the concept or utility of the invention. Define any terms that may have a special meaning. Give examples or relevant citations, authors, etc, if known. Please attach a copy of the cover sheet, pertinent claims, and abstract.

Title of Invention: Composite ion-exchange membranes  
Inventors (please provide full names): Kota Kikuchi, Yoshimitsu Sakaguchi, Shigenori Nagahara, Shiro Hamamoto, Naohiko Takimoto, etc.  
Earliest Priority Filing Date: 10/17/2002

\*For Sequence Searches Only\* Please include all pertinent information (parent, child, divisional, or issued patent numbers) along with the appropriate serial number.

Please, try to find the compounds represented by formulas (1)-(15) according claims 1-10

Thank you  
M. Bernstein

SCIENTIFIC REFERENCE BR.  
Sci & Tech Inf. Ctr  
NOV 28 2006  
Pat. & T.M. Office

*****		
STAFF USE ONLY	Type of Search	Vendors and cost where applicable
Searcher: <u>Jan</u>	NA Sequence (#) _____	STN <u>✓</u>
Searcher Phone #: <u>22504</u>	AA Sequence (#) _____	Dialog _____
Searcher Location: _____	Structure (#) <u>✓</u>	Questel/Orbit _____
Date Searcher Picked Up: <u>11/28/06</u>	Bibliographic _____	Dr.Link _____
Date Completed: <u>11/29/06</u>	Litigation _____	Lexis/Nexis _____
Searcher Prep & Review Time: _____	Fulltext _____	Sequence Systems _____
Clerical Prep Time: <u>30</u>	Patent Family _____	WWW/Internet _____
Online Time: <u>✓ 130</u>	Other _____	Other (specify) _____

=> fil reg

FILE 'REGISTRY' ENTERED AT 09:17:56 ON 29 NOV 2006

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Property values tagged with IC are from the ZIC/VINITI data file provided by InfoChem.

STRUCTURE FILE UPDATES: 27 NOV 2006 HIGHEST RN 914071-04-8.

DICTIONARY FILE UPDATES: 27 NOV 2006 HIGHEST RN 914071-04-8

New CAS Information Use Policies, enter HELP USAGETERMS for details.

TSCA INFORMATION NOW CURRENT THROUGH June 30, 2006

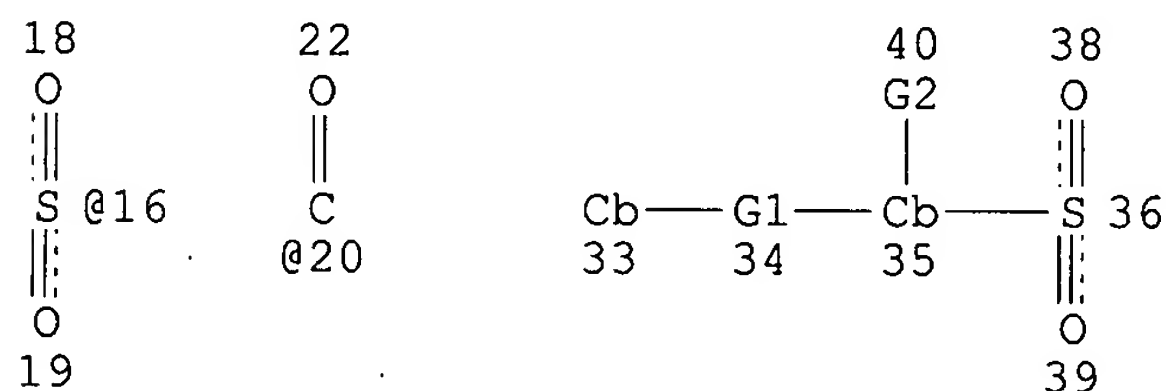
Please note that search-term pricing does apply when conducting SmartSELECT searches.

REGISTRY includes numerically searchable data for experimental and predicted properties as well as tags indicating availability of experimental property data in the original document. For information on property searching in REGISTRY, refer to:

<http://www.cas.org/ONLINE/UG/regprops.html>

=> d sta que l11

L7 STR



VAR G1=16/20

VAR G2=O/X

NODE ATTRIBUTES:

DEFAULT MLEVEL IS ATOM

GGCAT IS MCY UNS AT 33

GGCAT IS MCY UNS AT 35

DEFAULT ECLEVEL IS LIMITED

ECOUNT IS E6 C AT 33

ECOUNT IS E6 C AT 35

GRAPH ATTRIBUTES:

RING(S) ARE ISOLATED OR EMBEDDED

NUMBER OF NODES IS 12

STEREO ATTRIBUTES: NONE

L9 SCR 2043

L11 618 SEA FILE=REGISTRY SSS FUL L7 AND L9

100.0% PROCESSED 53347 ITERATIONS

SEARCH TIME: 00.00.01

618 ANSWERS

=&gt; d his

(FILE 'HOME' ENTERED AT 07:47:18 ON 29 NOV 2006)  
SET COST OFF

FILE 'HCAPLUS' ENTERED AT 07:47:48 ON 29 NOV 2006

L1 1 S US20060241192/PN OR (US2005-530965# OR WO2003-JP13278 OR JP20  
SEL RN

FILE 'REGISTRY' ENTERED AT 07:49:13 ON 29 NOV 2006

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L3 STR  
L4 20 S L3  
L5 STR L3  
L6 45 S L5  
L7 STR L5  
L8 2 S L7  
L9 SCR 2043  
L10 21 S L7 AND L9  
L11 618 S L7 AND L9 FUL  
SAV TEMP L11 BERN530/A  
L12 42 S L11 AND 1/NC  
L13 3 S L12 AND (C24H16O10S3 OR C25H16O9S2 OR C38H24O9S2)  
L14 11 S L12 AND (C27H22O10S3 OR C24H16O12S4 OR C31H30O10S3 OR C25H16O  
L15 10 S L14 NOT 196301-55-0  
L16 93 S L11 AND C12H10O2  
L17 82 S L11 AND 92-88-6/CRN  
L18 11 S L16 NOT L17  
L19 10 S L18 NOT 1079-21-6/CRN  
L20 92 S L17,L19  
L21 57 S L11 AND C25H18O2  
L22 57 S L11 AND 3236-71-3/CRN  
L23 57 S L21,L22  
L24 135 S L20,L23  
L25 31 S L11 AND 843-55-0/CRN  
L26 31 S L11 AND C18H20O2  
L27 31 S L25,L26  
L28 160 S L24,L27  
L29 3 S L2 AND L28  
L30 2 S L2 NOT L29  
L31 STR  
L32 0 S L31 SAM SUB=L11  
L33 47 S L31 FUL SUB=L11  
SAV TEMP L33 BERN530A/A  
L34 27 S L33 AND L28  
L35 7 S L34 AND ((C6-C6 OR NCNCNC)/ES OR C26H16CL2O4S OR C12H8CL2O5S2  
L36 20 S L34 NOT L35  
L37 153 S L28,L36 NOT L35  
L38 84 S L37 AND (C6H6O2 OR C13H8F2O7S2 OR C19H12F2O13S4)  
L39 15 S L38 NOT 345-92-6/CRN  
SEL RN 7 8 10 11 13 14  
L40 6 S E6-E11  
L41 69 S L38 NOT L39  
L42 5 S L41 AND 3/NC  
L43 29 S L41 AND 4/NC  
L44 5 S L43 AND NA/ELS  
L45 35 S L41 NOT L42-L44  
SEL RN 5 14 15 24 27 30 33  
L46 7 S E12-E18  
L47 4 S L40 NOT (862773-05-5 OR 1478-61-1/CRN)

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L48      2 S L15 AND (912548-40-4 OR 912548-38-0)
L49      69 S L37 NOT L38-L48
L50      13 S L49 AND C7H3CL2N
          SEL RN 3 4 6 7
L51      9 S L50 NOT E19-E22
L52      56 S L49 NOT L50
L53      12 S L52 AND 3/NC
          SEL RN 2 7 10 12
L54      4 S E23-E26
L55      22 S L52 AND 4/NC
          SEL RN 6 8 12 13 15-19 21 22
L56      11 S E27-E37
L57      22 S L52 NOT L53,L55
L58      50 S L13,L29,L42,L44,L46,L47,L48,L51,L54,L56
          SAV TEMP L58 BERN530B/A
L59      1 S 463-79-6
L60      7979 S 463-79-6/CRN.
L61      1 S L11 AND L60
L62      49 S L58 NOT L61

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FILE 'HCAPLUS' ENTERED AT 09:01:43 ON 29 NOV 2006

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L63      2 S L61
L64      106 S L62
L65      14 S L63,L64 AND L59,L60
L66      19 S L63,L64 AND (CARBONATE OR BICARBONATE OR CARBONIC ACID OR BIC
L67      21 S L65,L66
L68      8 S L63,L64 AND PY<=2002 NOT P/DT
L69      21 S L63,L64 AND (PD<=20021017 OR PRD<=20021017 OR AD<=20021017)
L70      7 S L68,L69 AND L67
L71      37 S L63,L64 AND (KITAMURA? OR SAKAGUCHI? OR NAGAHARA? OR HAMAMOTO
L72      40 S L63,L64 AND (TOYO? OR BOSEKI? OR KABUSHIKI?)/PA,CS
L73      5 S L71,L72 AND L68,L69
L74      10 S L70,L73
L75      11 S L68,L69 NOT L74
L76      4 S L74 AND (ION(L)EXCHANG?(L) (MEMBRAN? OR RESIN? OR COMPOSITION
L77      4 S L75 AND (ION(L)EXCHANG?(L) (MEMBRAN? OR RESIN? OR COMPOSITION
L78      8 S L76,L77
L79      13 S L74,L75 NOT L78
L80      3 S L79 AND L71,L72
L81      11 S L78,L80
L82      10 S L74,L75 NOT L81
          SEL AN DN 5 7-10
L83      5 S L82 NOT E38-E52
L84      16 S L81,L83
L85      5 S L74,L75 NOT L84
          E ION EXCHANGE/CT
          E E3+ALL
L86      26135 S E3+NT
L87      8009 S E11+OLD,NT OR E12+OLD,NT
          E E13+ALL
L88      45068 S E4,E5,E13,E16,E17,E18,E21-E23,E25
L89      4 S L68,L69 AND L86-L88
          E MEMBRANE/CT
          E E3+ALL
L90      43734 S E1
          E E2+ALL
L91      118206 S E3+OLD OR E15-E21
L92      11 S L68,L69 AND L90,L91
L93      17 S L84,L89,L92
L94      4 S L69,L69 NOT L93

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L95 21 S L93,L94 AND L1,L63-L94

FILE 'REGISTRY' ENTERED AT 09:17:56 ON 29 NOV 2006

=> fil hcaplus

FILE 'HCAPLUS' ENTERED AT 09:18:05 ON 29 NOV 2006

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FILE COVERS 1907 - 29 Nov 2006 VOL 145 ISS 23

FILE LAST UPDATED: 27 Nov 2006 (20061127/ED)

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This file contains CAS Registry Numbers for easy and accurate substance identification.

=> d l95 bib abs hitind hitstr retable tot

L95 ANSWER 1 OF 21 HCAPLUS COPYRIGHT 2006 ACS on STN

AN 2005:1132936 HCAPLUS

DN 143:406557

TI Ion-conductive copolymers containing one or more hydrophobic oligomers

IN Chen, Jian Ping

PA Polyfuel, Inc., USA

SO U.S. Pat. Appl. Publ., 38 pp., Cont.-in-part of U.S. Ser. No. 438,299.

CODEN: USXXCO

DT Patent

LA English

FAN.CNT 6

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	US 2005234146	A1	20051020	US 2004-987951	20041112 <--
	US 2004126666	A1	20040701	US 2003-438299	20030513 <--
	US 7094490	B2	20060822		
	US 2006135657	A1	20060622	US 2006-350228	20060207 <--
PRAI	US 2002-381136P	P	20020513	<--	
	US 2003-438299	A2	20030513		
	US 2003-520266P	P	20031113		
	US 2004-545293P	P	20040217		
	US 2003-449299P	P	20030220		

AB In one aspect, the invention provides ion conductive copolymers comprising (1) a plurality of first oligomers, (2) a plurality of second oligomers, (3) ion conductive monomers and (4) linking monomers. The oligomers preferably are hydrophobic and together with the ion conductive monomers are randomly dispersed between the linking monomers. Uses of such polymeric materials include the formation of polymer electrolyte membranes (PEMs), catalyst coated membranes (CCM's) and membrane electrolyte

assemblies (MEA's) which may be used in fuel cells and the like. An ion-conducting copolymer was prepared from a 9,9-bis(4-hydroxyphenyl)fluorene-4,4'-difluorobenzophone oligomer.

IC ICM C08G0002-00

INCL 522090000

CC 37-3 (Plastics Manufacture and Processing)

IT **Ion exchange membranes**

(proton **exchange**; ion-conductive copolymers containing one or more hydrophobic oligomers)

IT 40793-56-4P, 9,9-Bis(4-hydroxyphenyl)fluorene-4,4'-difluorobenzophone copolymer 690662-65-8P **690662-70-5P** 690662-71-6P

690662-72-7P 690662-75-0P 690662-76-1P 690662-79-4P 690662-81-8P

690662-82-9P 690663-41-3P 867044-45-9P 867044-46-0P 867044-47-1P

867044-48-2P 867044-49-3P 867044-50-6P 867044-51-7P 867044-52-8P

RL: IMF (Industrial manufacture); PREP (Preparation)

(ion-conductive copolymers containing one or more hydrophobic oligomers)

IT **690662-70-5P**

RL: IMF (Industrial manufacture); PREP (Preparation)

(ion-conductive copolymers containing one or more hydrophobic oligomers)

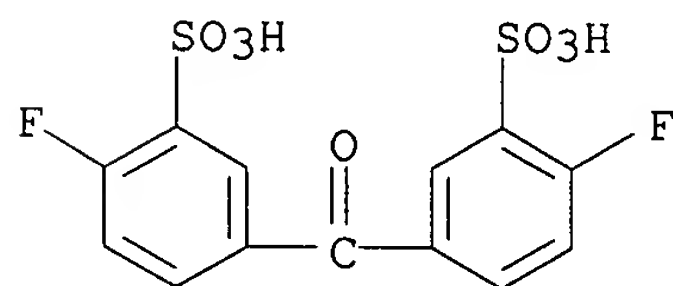
RN 690662-70-5 HCAPLUS

CN Benzenesulfonic acid, 3,3'-carbonylbis[6-fluoro-, polymer with bis(4-fluorophenyl)methanone and 4,4'-cyclohexylidenebis[phenol], block (9CI) (CA INDEX NAME)

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CRN 625392-06-5

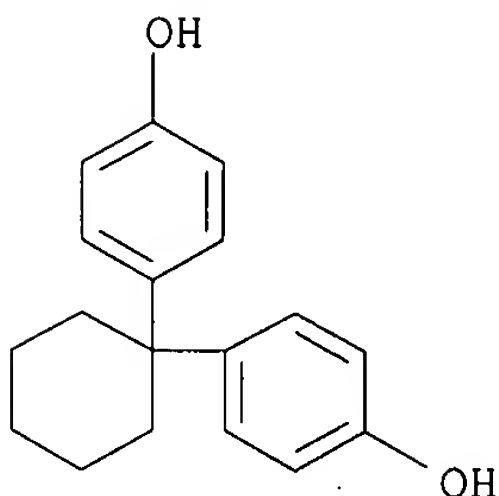
CMF C13 H8 F2 O7 S2



CM 2

CRN 843-55-0

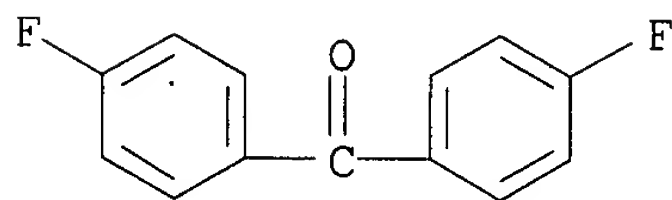
CMF C18 H20 O2



CM 3



CRN 345-92-6  
CMF C13 H8 F2 O



L95 ANSWER 2 OF 21 HCAPLUS COPYRIGHT 2006 ACS on STN  
AN 2005:824448 HCAPLUS  
DN 143:232677  
TI Ion conductive random copolymers for electrolyte membranes in fuel cells  
IN Cao, Shuguang; Chen, Jian Ping; Jeanes, Thomas; Nam, Kie Hyun; Olmeijer, David; Xu, Helen  
PA USA  
SO U.S. Pat. Appl. Publ., 17 pp., Cont.-in-part of U.S. Ser. No. 438,186.  
CODEN: USXXCO

DT Patent  
LA English

FAN.CNT 6

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	US 2005181256	A1	20050818	US 2004-987178	20041112 <--
	US 2004039148	A1	20040226	US 2003-438186	20030513 <--
	US 2006135657	A1	20060622	US 2006-350228	20060207 <--
PRAI	US 2002-381136P	P	20020514	<--	
	US 2002-426540P	P	20021115		
	US 2003-446395P	P	20030210		
	US 2003-438186	A2	20030513		
	US 2003-449299P	P	20030220		
	US 2003-438299	A3	20030513		

AB This invention relates to **ion** conducting random copolymers that are useful in forming polymer electrolyte **membranes** used in fuel cells. A catalyst-coated **membrane** comprises a proton **exchange membrane** where all or part of  $\geq 1$  of the opposing surface of the **membrane** comprises a catalyst layer.

IC ICM H01M0008-00

INCL 429033000; X42-931.4; X42-931.7; X52-628.7; X52-631.6; X52-630.75

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 38

IT **Membranes, nonbiological**

(catalyst-coated; ion conductive random copolymers for electrolyte membranes in fuel cells)

IT Fuel cells

(proton **exchange membrane**; **ion** conductive random copolymers for electrolyte **membranes** in fuel cells)

IT 210531-46-7P 334658-51-4P 474242-19-8P 737611-77-7P 862772-88-1P  
862772-89-2P 862772-90-5P **862772-91-6P 862772-92-7P**

**862772-93-8P 862772-94-9P 862772-95-0P**

862772-96-1P 862772-97-2P 862772-98-3P 862772-99-4P 862773-00-0P

862773-01-1P **862773-02-2P** 862773-03-3P 862773-04-4P

862773-05-5P 862773-06-6P 862773-07-7P 862773-08-8P

RL: DEV (Device component use); PRP (Properties); SPN (Synthetic preparation); PREP (Preparation); USES (Uses)

(ion conductive random copolymers for electrolyte membranes in fuel cells)

IT **862772-91-6P 862772-92-7P 862772-93-8P**



862772-94-9P 862772-95-0P 862773-02-2P

RL: DEV (Device component use); PRP (Properties); SPN (Synthetic preparation); PREP (Preparation); USES (Uses)

(ion conductive random copolymers for electrolyte membranes in fuel cells)

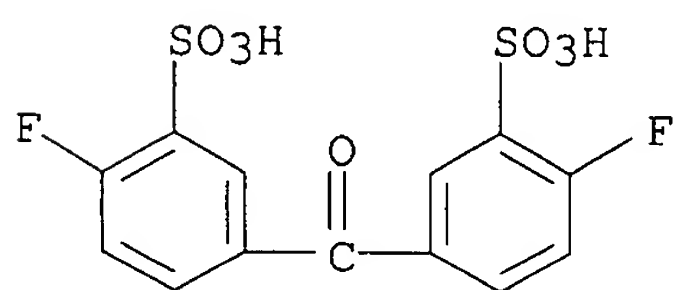
RN 862772-91-6 HCAPLUS

CN Benzenesulfonic acid, 3,3'-carbonylbis[6-fluoro-, disodium salt, polymer with bis(4-fluorophenyl)methanone and 4,4'-cyclohexylidenebis[phenol] (9CI) (CA INDEX NAME)

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CRN 210531-45-6

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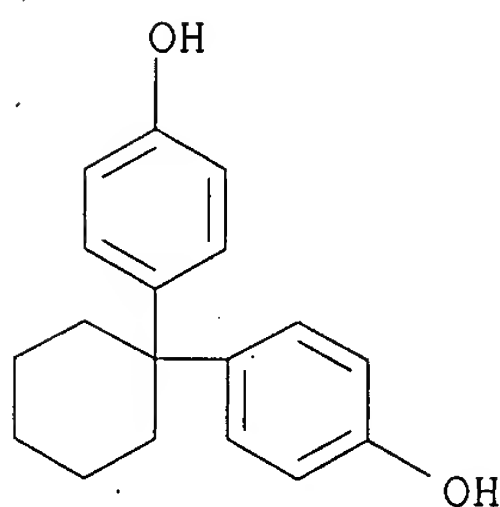


● 2 Na

CM 2

CRN 843-55-0

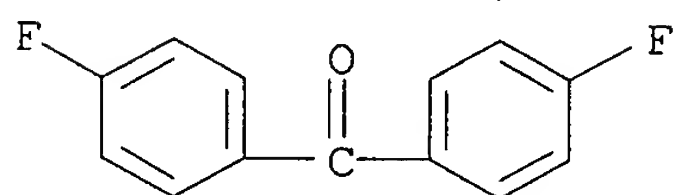
CMF C18 H20 O2



CM 3

CRN 345-92-6

CMF C13 H8 F2 O

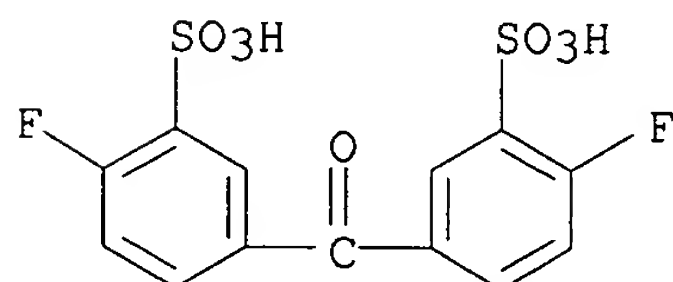


RN 862772-92-7 HCAPLUS  
 CN Benzenesulfonic acid, 3,3'-carbonylbis[6-fluoro-, disodium salt, polymer  
 with 4,4'-cyclohexylidenebis[phenol] and 1,1'-sulfonylbis[4-fluorobenzene]  
 (9CI) (CA INDEX NAME)

CM 1

CRN 210531-45-6

CMF C13 H8 F2 O7 S2 . 2 Na

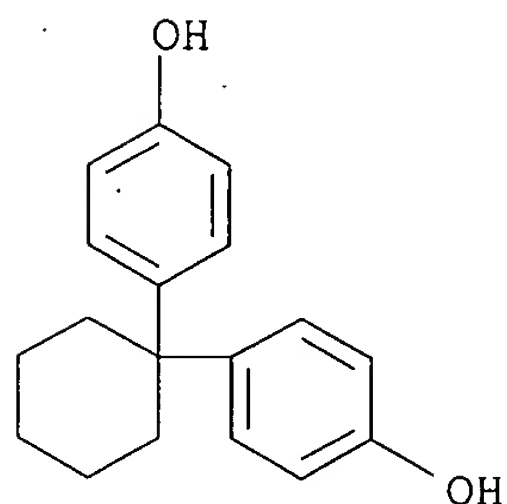


● 2 Na

CM 2

CRN 843-55-0

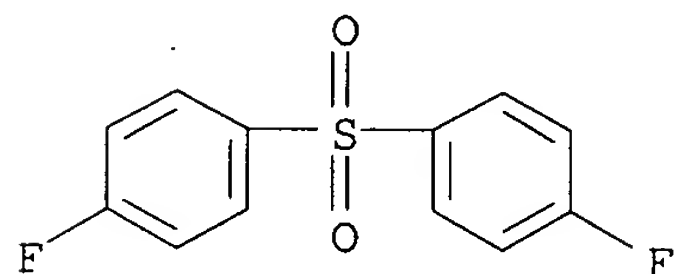
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CM 3

CRN 383-29-9

CMF C12 H8 F2 O2 S

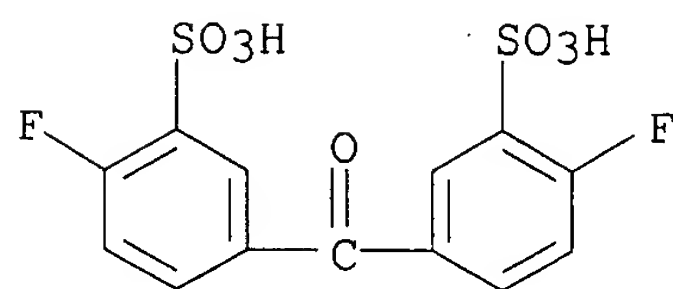


RN 862772-93-8 HCAPLUS  
 CN Benzenesulfonic acid, 3,3'-carbonylbis[6-fluoro-, disodium salt, polymer  
 with bis(4-fluorophenyl)methanone, 4,4'-cyclohexylidenebis[phenol] and  
 2,6-difluorobenzonitrile (9CI) (CA INDEX NAME)

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CRN 210531-45-6

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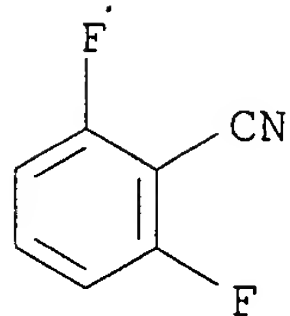


● 2 Na

CM 2

CRN 1897-52-5

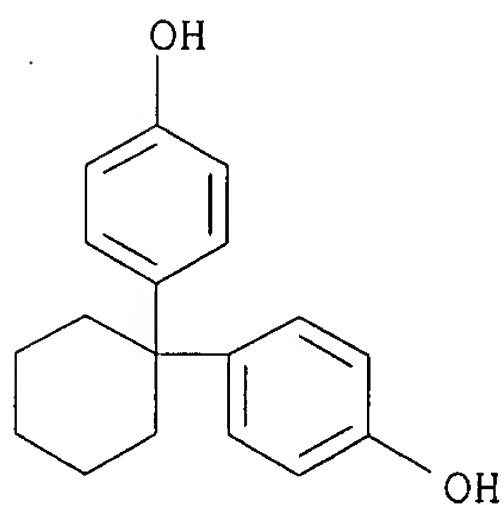
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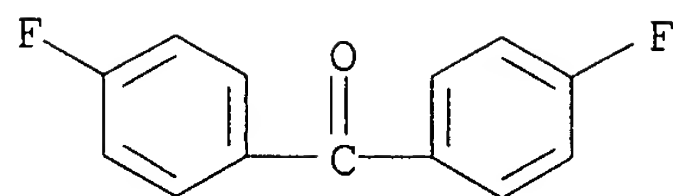
CMF C18 H20 O2



CM 4

CRN 345-92-6

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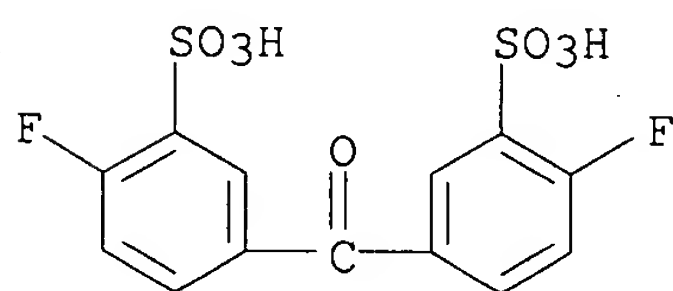


RN 862772-94-9 HCAPLUS  
 CN Benzenesulfonic acid, 3,3'-carbonylbis[6-fluoro-, disodium salt, polymer  
 with bis(4-fluorophenyl)methanone and 4,4'-(9H-fluoren-9-  
 ylidene)bis[phenol] (9CI) (CA INDEX NAME)

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CRN 210531-45-6

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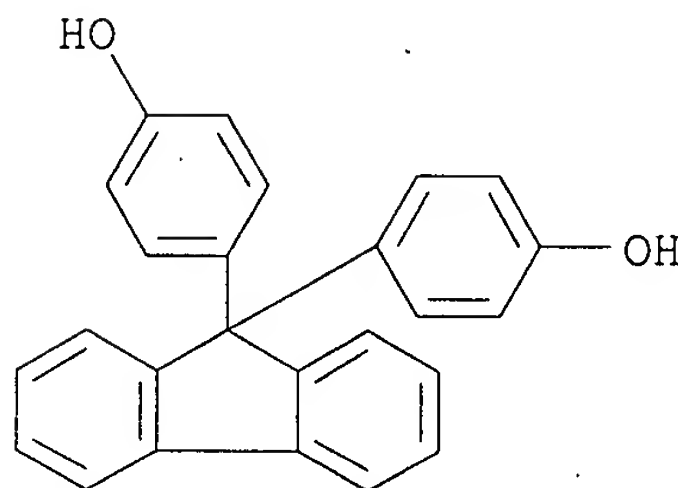


● 2 Na

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CRN 3236-71-3

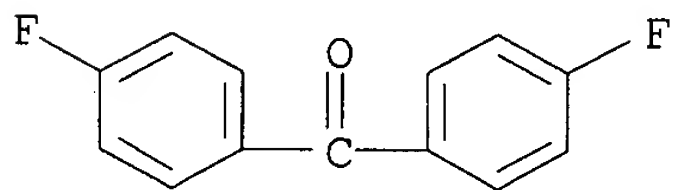
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CRN 345-92-6

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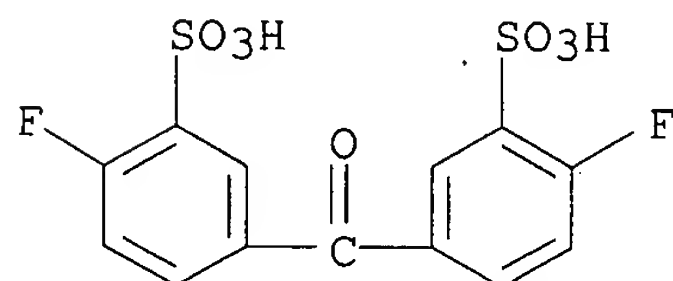


RN 862772-95-0 HCAPLUS  
 CN Benzenesulfonic acid, 3,3'-carbonylbis[6-fluoro-, disodium salt, polymer  
 with bis(4-fluorophenyl)methanone, 4,4'-cyclohexylidenebis[phenol] and  
 4,4'-(9H-fluoren-9-ylidene)bis[phenol] (9CI) (CA INDEX NAME)

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CRN 210531-45-6

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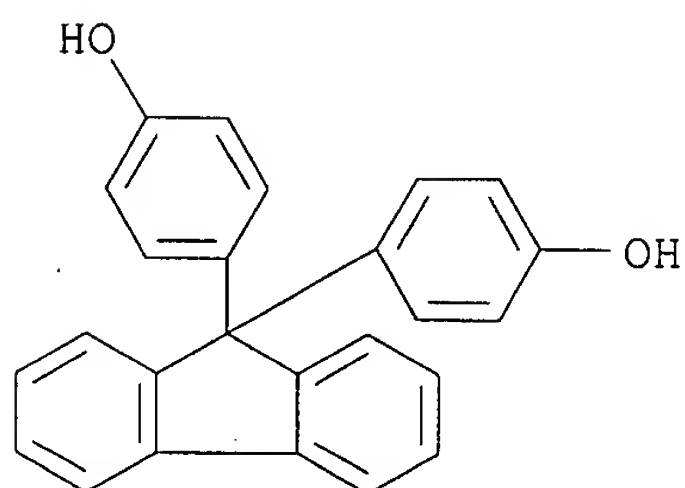


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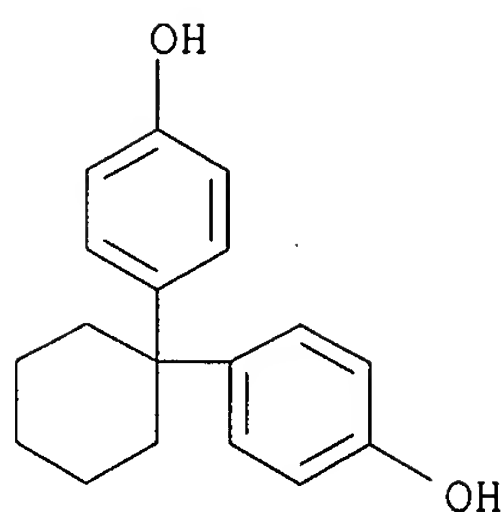
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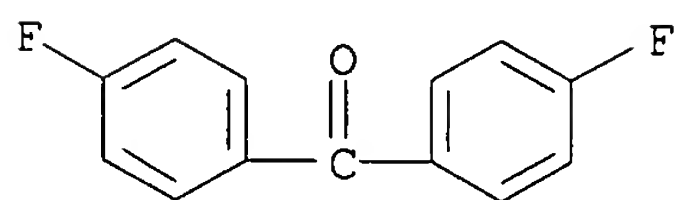
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CM 4

CRN 345-92-6

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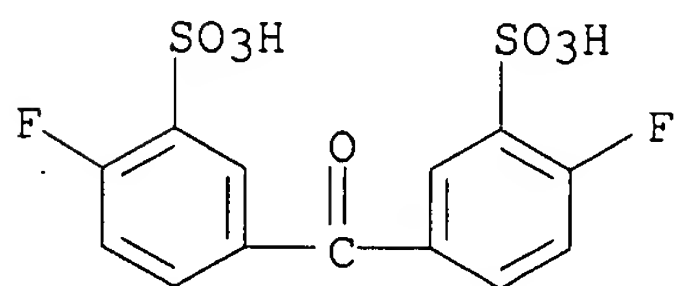
RN 862773-02-2 HCAPLUS

CN Benzenesulfonic acid, 3,3'-carbonylbis[6-fluoro-, disodium salt, polymer with [1,1'-biphenyl]-4,4'-diol and bis(4-fluorophenyl)methanone (9CI) (CA INDEX NAME)

CM 1

CRN 210531-45-6

CMF C13 H8 F2 O7 S2 . 2 Na

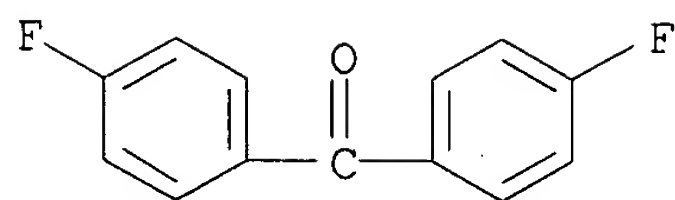


● 2 Na

CM 2

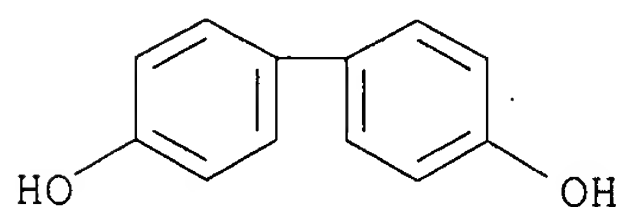
CRN 345-92-6

CMF C13 H8 F2 O



CM 3

CRN 92-88-6  
CMF C12 H10 O2



L95 ANSWER 3 OF 21 HCAPLUS COPYRIGHT 2006 ACS on STN  
AN 2004:414812 HCAPLUS  
DN 140:409658  
TI Ion conductive block copolymers for polymer electrolyte membrane fuel cells  
IN Xu, Helen; Cao, Shuguang; Chen, Jingping; Jeanes, Thomas; Nam, Kie Hyun  
PA Polyfuel, Inc., USA  
SO PCT Int. Appl., 53 pp.  
CODEN: PIXXD2  
DT Patent  
LA English  
FAN.CNT 6

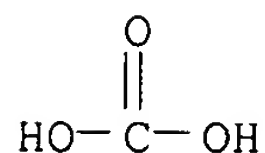
	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 2004042839	A2	20040521	WO 2003-US15351	20030513 <--
	WO 2004042839	A3	20050127		
	W:	AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW			
	RW:	GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR, BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG			
	CA 2485971	AA	20040521	CA 2003-2485971	20030513 <--
	AU 2003299502	A1	20040607	AU 2003-299502	20030513 <--
	EP 1518290	A2	20050330	EP 2003-799789	20030513 <--
	R:	AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO, MK, CY, AL, TR, BG, CZ, EE, HU, SK			
	CN 1669169	A	20050914	CN 2003-816347	20030513 <--
	JP 2006512428	T2	20060413	JP 2004-549894	20030513 <--
	US 2006135657	A1	20060622	US 2006-350228	20060207 <--
PRAI	US 2002-381136P	P	20020514	<--	
	US 2003-449299P	P	20030220		
	US 2003-438299	A3	20030513		
	WO 2003-US15351	W	20030513		

AB This invention relates to ion conductive copolymers which are useful in



forming polymer electrolyte membranes used in fuel cells. In a catalyst coated membrane, at least one of the opposing surfaces of the membrane comprises a catalyst layer.

IC ICM H01M  
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 Section cross-reference(s): 38  
 IT **584-08-7P**, Potassium **carbonate** 25897-65-8P, Bisphenol  
 A-4,4'-difluorobenzophenone copolymer 40793-56-4P, 9,9-Bis(4-  
 hydroxyphenyl)fluorene-4,4'-difluorobenzophenone copolymer 69254-20-2P  
 117344-37-3P 125938-56-9P 193410-35-4P, 4,4'-Difluorobenzophenone-4,4'-  
 dihydroxydiphenyl ether copolymer 625392-07-6P 690662-65-8P  
**690662-66-9P** 690662-67-0P 690662-68-1P 690662-69-2P  
**690662-70-5P** 690662-71-6P 690662-72-7P 690662-73-8P  
 690662-74-9P 690662-75-0P 690662-76-1P 690662-77-2P 690662-78-3P  
 690662-79-4P 690662-80-7P 690662-81-8P 690662-82-9P 690663-41-3P  
 RL: SPN (Synthetic preparation); PREP (Preparation)  
 (ion conductive block copolymers for polymer electrolyte membrane fuel  
 cells)  
 IT **584-08-7P**, Potassium **carbonate** **690662-66-9P**  
**690662-70-5P**  
 RL: SPN (Synthetic preparation); PREP (Preparation)  
 (ion conductive block copolymers for polymer electrolyte membrane fuel  
 cells)  
 RN 584-08-7 HCAPLUS  
 CN Carbonic acid, dipotassium salt (8CI, 9CI) (CA INDEX NAME)



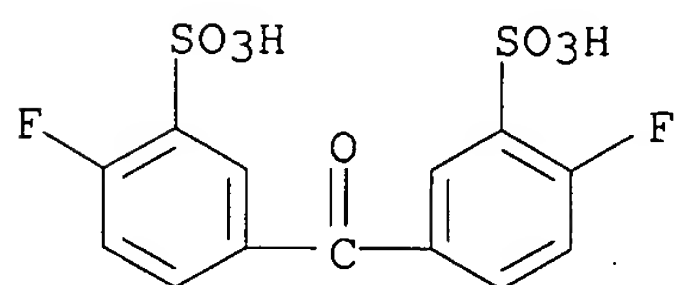
● 2 K

RN 690662-66-9 HCAPLUS  
 CN Benzenesulfonic acid, 3,3'-carbonylbis[6-fluoro-, polymer with  
 bis(4-fluorophenyl)methanone and 4,4'-(9H-fluoren-9-ylidene)bis[phenol],  
 block (9CI) (CA INDEX NAME)

CM 1

CRN 625392-06-5

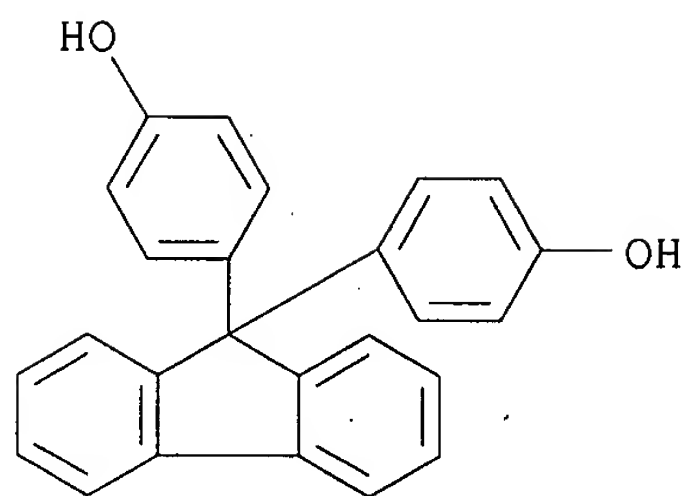
CMF C13 H8 F2 O7 S2



CM 2

CRN 3236-71-3

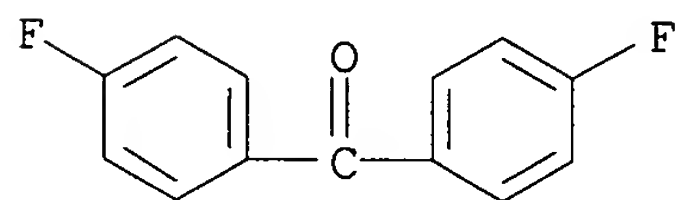
CMF C25 H18 O2



CM 3

CRN 345-92-6

CMF C13 H8 F2 O



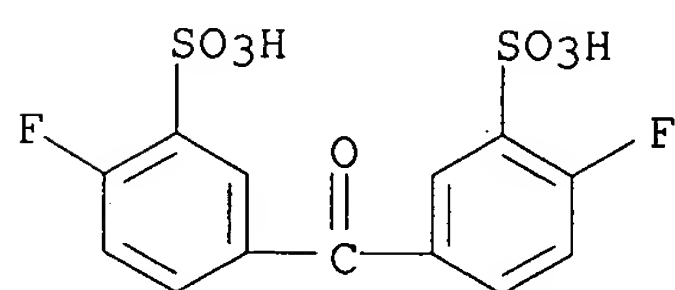
RN 690662-70-5 HCAPLUS

CN Benzenesulfonic acid, 3,3'-carbonylbis[6-fluoro-, polymer with bis(4-fluorophenyl)methanone and 4,4'-cyclohexylidenebis[phenol], block (9CI) (CA INDEX NAME)

CM 1

CRN 625392-06-5

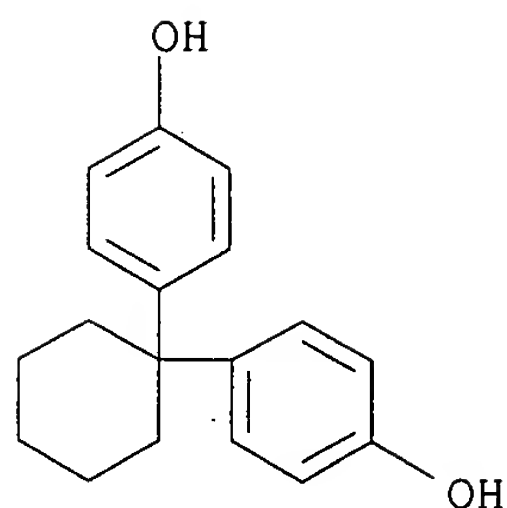
CMF C13 H8 F2 O7 S2



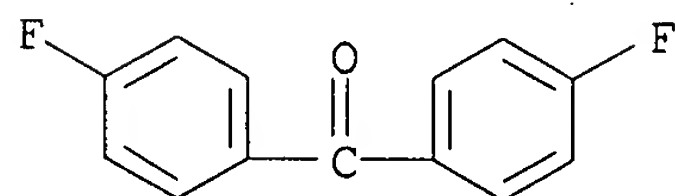
CM 2

CRN 843-55-0

CMF C18 H20 O2



CM 3

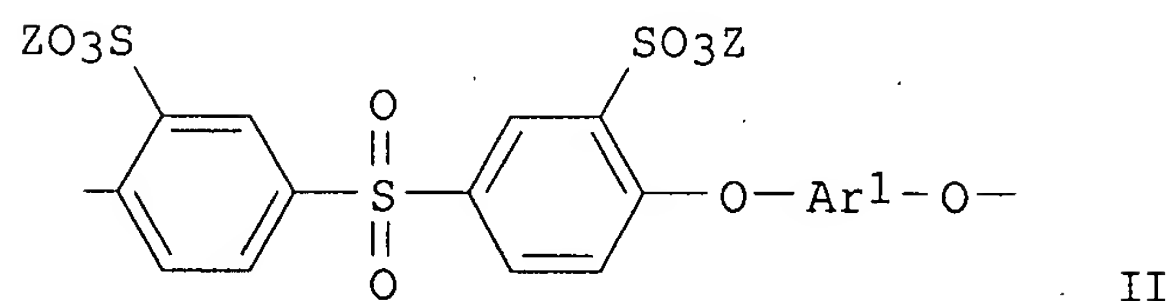
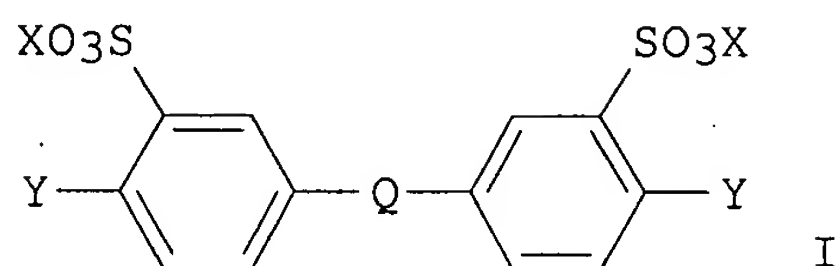
 CRN 345-92-6  
 CMF C13 H8 F2 O


L95 ANSWER 4 OF 21 HCAPLUS COPYRIGHT 2006 ACS on STN  
 AN 2004:355275 HCAPLUS  
 DN 140:376230  
 TI Composite ion exchanger membrane  
 IN Kitamura, Kota; Sakaguchi, Yoshimitsu; Nagahara, Shigenori; Hamamoto, Shiro; Takimoto, Naohiko; Sugihara, Hideki; Takase, Satoshi; Kitagawa, Tooru; Saito, Miyako  
 PA Toyo Boseki Kabushiki Kaisha, Japan  
 SO PCT Int. Appl., 92 pp.  
 CODEN: PIXXD2  
 DT Patent  
 LA Japanese  
 FAN.CNT 1

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI WO 2004036679	A1	20040429	WO 2003-JP13278	20031016 <--
W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, KE, KG, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW				
RW: GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR, BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG				
JP 2004139836	A2	20040513	JP 2002-303289	20021017 <--
JP 2004139837	A2	20040513	JP 2002-303290	20021017 <--
JP 2004143388	A2	20040520	JP 2002-312837	20021028 <--
JP 2004169003	A2	20040617	JP 2003-355364	20031015 <--
AU 2003273034	A1	20040504	AU 2003-273034	20031016 <--
US 2006241192	A1	20061026	US 2005-530965	20050411 <--

PRAI JP 2002-303289 A 20021017 <--  
 JP 2002-303290 A 20021017 <--  
 JP 2002-312837 A 20021028 <--  
 JP 2002-313025 A 20021028 <--  
 WO 2003-JP13278 W 20031016 <--

GI



AB The **membrane** has **ion exchanger resin**  
 in the continuous through holes in a support **membrane**, where the  
**ion exchanger resin** contains an aromatic ether  
 and/or its derivative, formed by polymerization of mixture containing monomers

I (Q =-SO2-  
 or -CO-, X = H, Li, NA, or K, Y = F, Cl, Br, or I), aromatic dihalides, and  
 bisphenol compound and alkali metal (bi)**carbonate**. The  
**ion exchange resin** contain 0-1000 structural  
 units II (Z = H, Li, Na, K, or cation derived. from aliphatic or aromatic  
 amines; Ar1 and Ar3 = bivalent organic groups, Ar2 = bivalent organic groups  
 containing ≥1 arom ring having electron attracting group) and 0-1000  
 structural units III. The **composite membrane** may be  
 used as fuel cell electrolyte.

IC ICM H01M0008-02

ICS C08J0005-22

CC 38-3 (Plastics Fabrication and Uses)

Section cross-reference(s): 52

ST **composite ion exchanger membrane**

**compn** fuel cell electrolyte

IT Fuel cell electrolytes

(composite membranes containing ion  
 exchanger resins in porous polymer support  
 membranes for fuel cell electrolytes)

IT Polyphosphoric acids

RL: TEM (Technical or engineered material use); USES (Uses)

(composite membranes containing ion  
 exchanger resins in porous polymer support  
 membranes for fuel cell electrolytes)

IT 75-75-2, Methanesulfonic acid 60871-72-9 146673-89-4

267877-35-0 681035-31-4

RL: TEM (Technical or engineered material use); USES (Uses)

(composite membranes containing ion  
exchanger resins in porous polymer support  
membranes for fuel cell electrolytes)

IT 146673-89-4 267877-35-0 681035-31-4

RL: TEM (Technical or engineered material use); USES (Uses)

(composite membranes containing ion  
exchanger resins in porous polymer support  
membranes for fuel cell electrolytes)

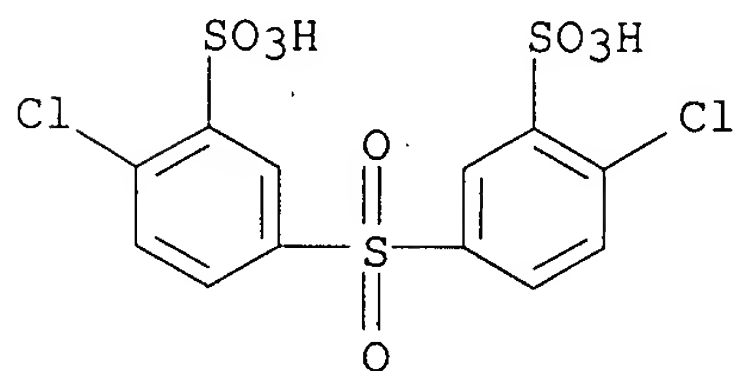
RN 146673-89-4 HCAPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, disodium salt, polymer  
with 4,4'-(9H-fluoren-9-ylidene)bis[phenol] and 1,1'-sulfonylbis[4-  
chlorobenzene] (9CI) (CA INDEX NAME)

CM 1

CRN 51698-33-0

CMF C12 H8 Cl2 O8 S3 . 2 Na

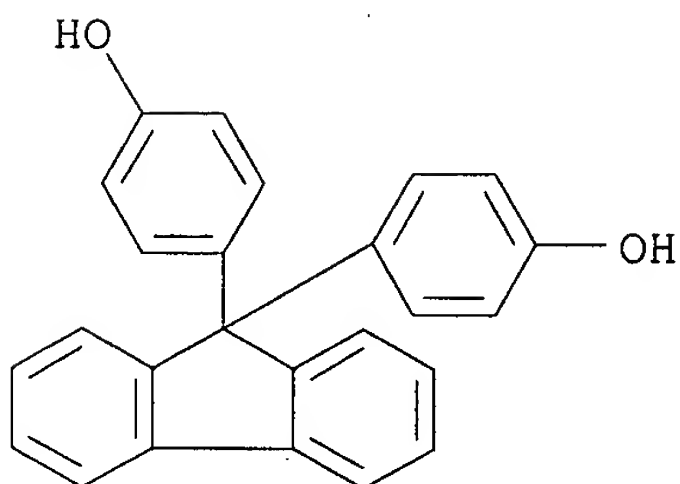


● 2 Na

CM 2

CRN 3236-71-3

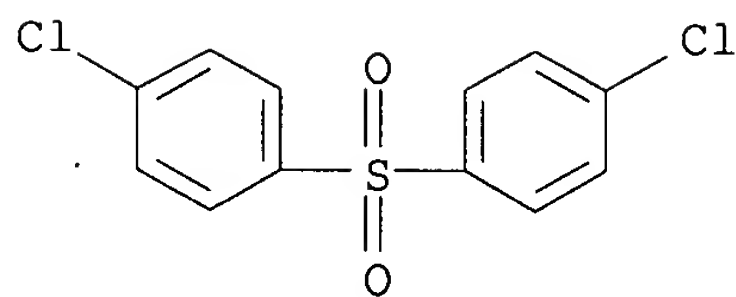
CMF C25 H18 O2



CM 3

CRN 80-07-9

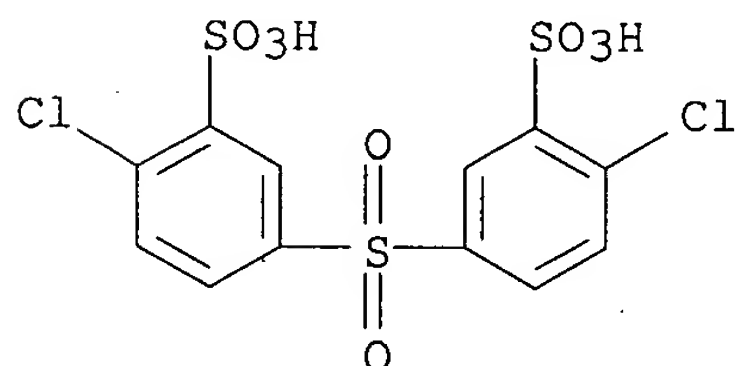
CMF C12 H8 Cl2 O2 S



RN 267877-35-0 HCAPLUS  
 CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, disodium salt, polymer  
 with [1,1'-biphenyl]-4,4'-diol and 1,1'-sulfonylbis[4-chlorobenzene] (9CI)  
 (CA INDEX NAME)

CM 1

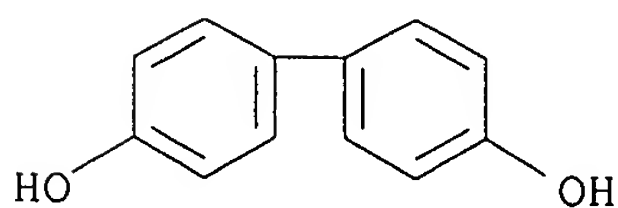
CRN 51698-33-0  
 CMF C12 H8 Cl2 O8 S3 . 2 Na



● 2 Na

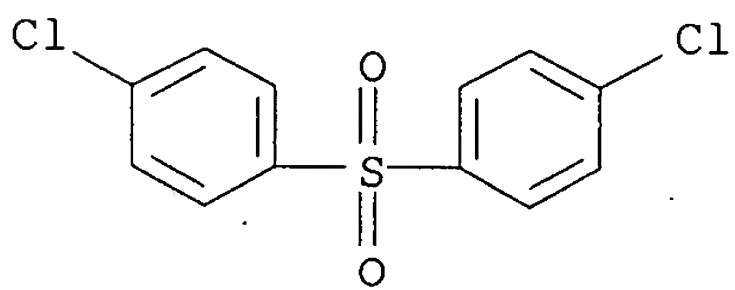
CM 2

CRN 92-88-6  
 CMF C12 H10 O2



CM 3

CRN 80-07-9  
 CMF C12 H8 Cl2 O2 S

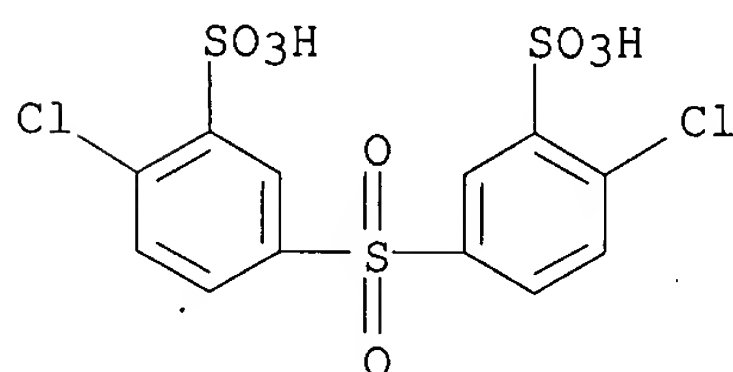


RN 681035-31-4 HCAPLUS  
 CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, disodium salt, polymer  
 with [1,1'-biphenyl]-4,4'-diol and 2,6-dichlorobenzonitrile (9CI) (CA  
 INDEX NAME)

CM 1

CRN 51698-33-0

CMF C12 H8 C12 O8 S3 . 2 Na

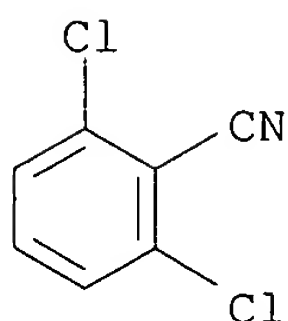


● 2 Na

CM 2

CRN 1194-65-6

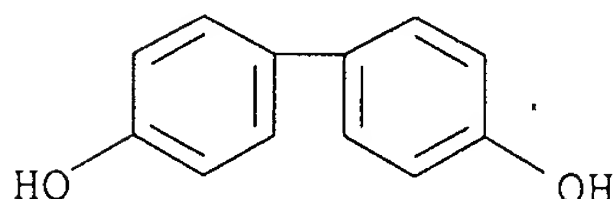
CMF C7 H3 C12 N



CM 3

CRN 92-88-6

CMF C12 H10 O2



L95 ANSWER 5 OF 21 HCAPLUS COPYRIGHT 2006 ACS on STN

AN 2004:333769 HCAPLUS

DN 140:340474

TI Polyarylene ether compounds containing sulfonic acid groups, their  
 compositions and manufacture method

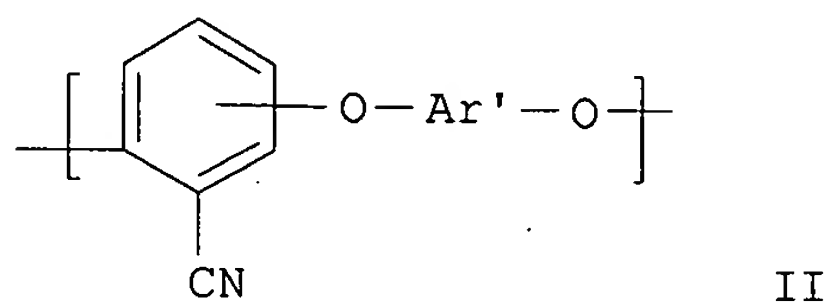
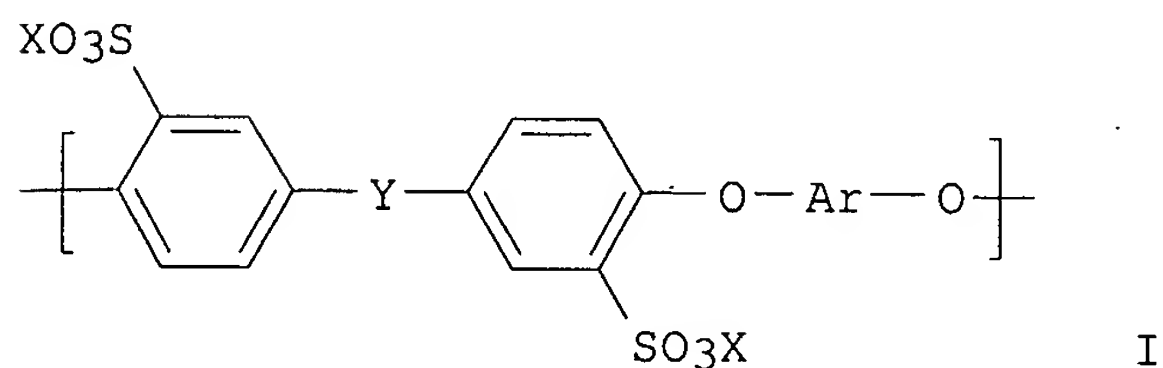
IN **Sakaguchi, Yoshimitsu; Kitamura, Kota; Nagahara,  
 Shigenori; Yamashita, Masahiro; Nakao, Junko**



PA Toyo Boseki Kabushiki Kaisha, Japan  
 SO PCT Int. Appl., 75 pp.  
 CODEN: PIXXD2  
 DT Patent  
 LA Japanese  
 FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 2004033534	A1	20040422	WO 2003-JP12850	20031007 <--
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	RW: GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR, BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG				
	JP 2004244437	A2	20040902	JP 2003-32622	20030210
	AU 2003268784	A1	20040504	AU 2003-268784	20031007 <--
	JP 2004149779	A2	20040527	JP 2003-348477	20031007 <--
	EP 1561768	A1	20050810	EP 2003-748749	20031007 <--
	R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO, MK, CY, AL, TR, BG, CZ, EE, HU, SK				
	CN 1703443	A	20051130	CN 2003-80100996	20031007 <--
	JP 2004263167	A2	20040924	JP 2003-367183	20031028
	US 2006166048	A1	20060727	US 2005-530199	20050404 <--
PRAI	JP 2002-295284	A	20021008	<--	
	JP 2003-32621	A	20030210		
	JP 2003-32622	A	20030210		
	WO 2003-JP12850	W	20031007		

GI



AB The title polymers, showing good ion conductivity and heat resistance, comprise the units of I and II (Ar, Ar' = divalent aromatic group; X = H, monovalent cation; Y = SO<sub>2</sub>, CO). The polymers and their compns. containing polybenzimidazoles are useful for ion-conductive films, electrolytes, fuel cells, and adhesives. Thus, a 1:0.38:0.62 (mol) 4,4'-biphenol-3,3'-

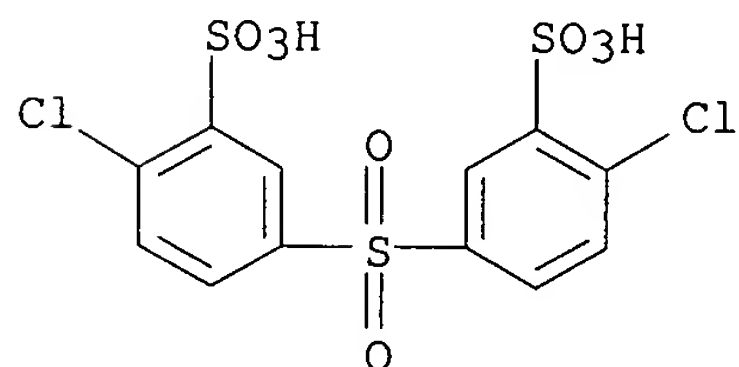
disulfo-4,4'-dichlorodiphenylsulfone disodium salt-2,6-dichlorobenzonitrile copolymer was prepared and made into a film showing 3%-weight loss temperature 380° and ion conductivity 0.14 S/cm.

IC ICM C08G0065-40  
ICS C09J0171-08; H01M0008-02; H01M0008-10  
CC 38-3 (Plastics Fabrication and Uses)  
Section cross-reference(s): 37, 52  
IT 425636-38-0P, 2,5-Dicarboxybenzenesulfonic acid monosodium salt-3,3',4,4'-tetraaminodiphenylsulfone copolymer 426255-33-6P  
**681035-31-4P**  
RL: IMF (Industrial manufacture); POF (Polymer in formulation); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
(heat-resistant sulfo-containing polyethers for ion-conductive films)  
IT 94196-53-9DP, sulfonated 94196-69-7DP, 4,4'-Biphenol-2,6-dichlorobenzonitrile copolymer, sulfonated **681035-32-5P**  
681035-34-7DP, sulfonated **681035-35-8P** 681035-36-9P  
**681035-37-0P** 681144-72-9DP, sulfonated  
RL: IMF (Industrial manufacture); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
(heat-resistant sulfo-containing polyethers for ion-conductive films)  
IT **681035-31-4P**  
RL: IMF (Industrial manufacture); POF (Polymer in formulation); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
(heat-resistant sulfo-containing polyethers for ion-conductive films)  
RN 681035-31-4 HCAPLUS  
CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, disodium salt, polymer with [1,1'-biphenyl]-4,4'-diol and 2,6-dichlorobenzonitrile (9CI) (CA INDEX NAME)

CM 1

CRN 51698-33-0

CMF C12 H8 Cl2 O8 S3 . 2 Na

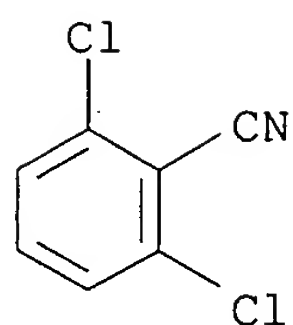


● 2 Na

CM 2

CRN 1194-65-6

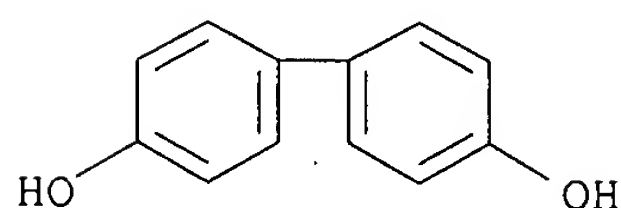
CMF C7 H3 Cl2 N



CM 3

CRN 92-88-6

CMF C12 H10 O2



IT 681035-32-5P 681035-35-8P 681035-37-0P

RL: IMF (Industrial manufacture); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
(heat-resistant sulfo-containing polyethers for ion-conductive films)

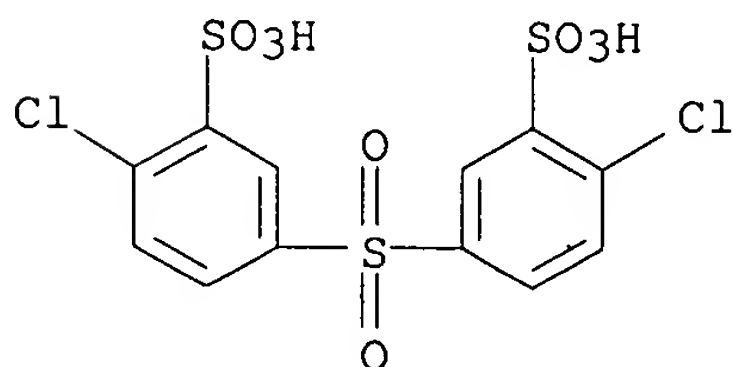
RN 681035-32-5 HCAPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, disodium salt, polymer with [1,1'-biphenyl]-4,4'-diol, 2,6-dichlorobenzonitrile and 1,1'-sulfonylbis[4-chlorobenzene] (9CI) (CA INDEX NAME)

CM 1

CRN 51698-33-0

CMF C12 H8 Cl2 O8 S3 . 2 Na

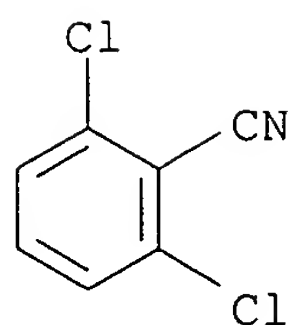


● 2 Na

CM 2

CRN 1194-65-6

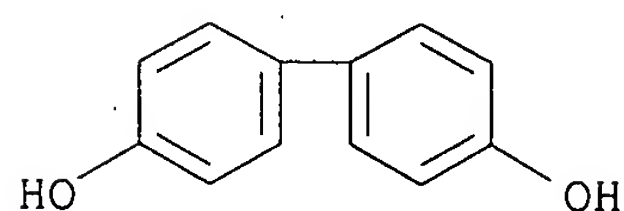
CMF C7 H3 Cl2 N



CM 3

CRN 92-88-6

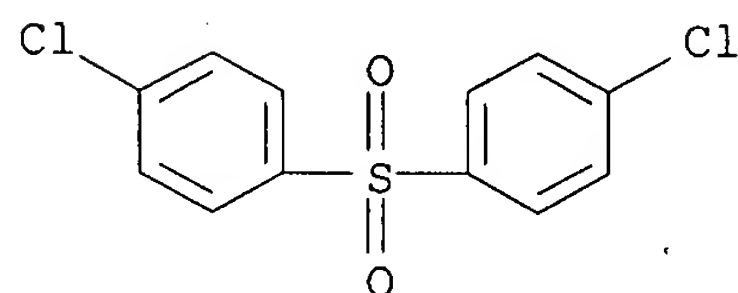
CMF C12 H10 O2



CM 4

CRN 80-07-9

CMF C12 H8 C12 O2 S



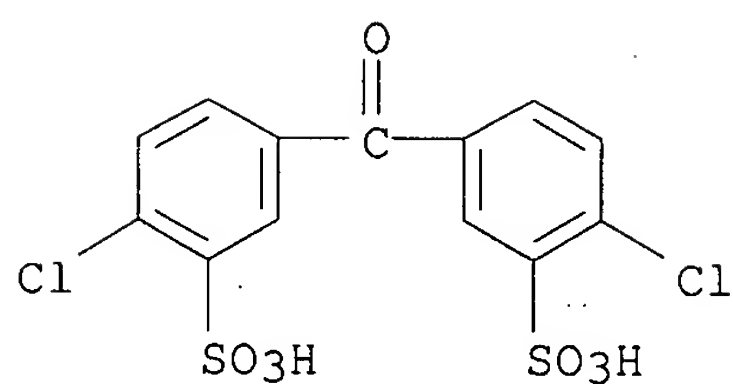
RN 681035-35-8 HCAPLUS

CN Benzenesulfonic acid, 3,3'-carbonylbis[6-chloro-, disodium salt, polymer with [1,1'-biphenyl]-4,4'-diol and 2,6-dichlorobenzonitrile (9CI) (CA INDEX NAME)

CM 1

CRN 57004-46-3

CMF C13 H8 C12 O7 S2 . 2 Na

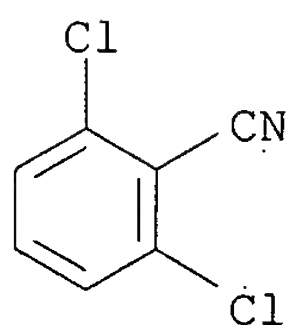


● 2 Na

CM 2

CRN 1194-65-6

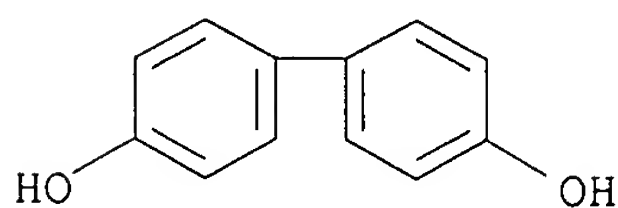
CMF C7 H3 Cl2 N



CM 3

CRN 92-88-6

CMF C12 H10 O2



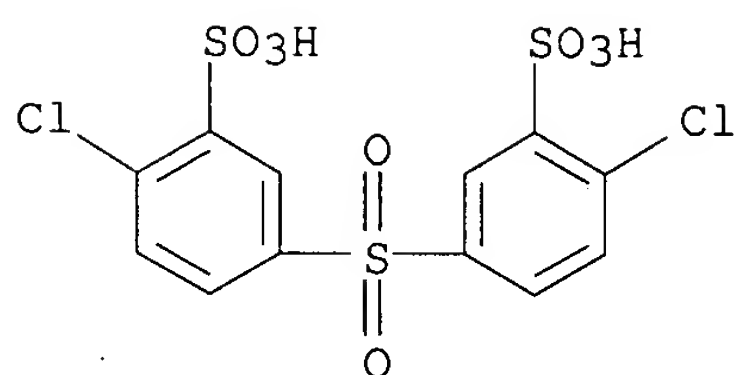
RN 681035-37-0 HCAPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, disodium salt, polymer with [1,1'-biphenyl]-4,4'-diol and 2,4-difluorobenzonitrile (9CI) (CA INDEX NAME)

CM 1

CRN 51698-33-0

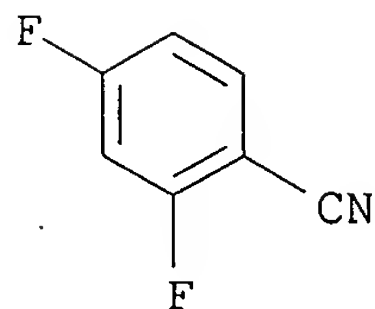
CMF C12 H8 Cl2 O8 S3 . 2 Na



●2 Na

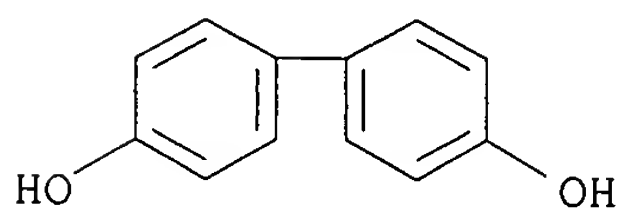
CM 2

CRN 3939-09-1  
CMF C7 H3 F2 N



CM 3

CRN 92-88-6  
CMF C12 H10 O2



# RETABLE

Referenced Author (RAU)	Year (RPY)	VOL (RVL)	PG (RPG)	Referenced Work (RWK)	Referenced File
Foster-Miller Inc	1999			JP 2003503510 A	
Foster-Miller Inc	1999			WO 99010165 A	
Honda Motor Co Ltd	2002			JP 2002367629 A	HCAPLUS
Jsr Corp	2002			JP 2002220530 A	HCAPLUS
Toyobo Co Ltd	2003			JP 2003012795 A	HCAPLUS
Toyobo Co Ltd	2003			JP 2003217342 A	HCAPLUS

L95 ANSWER 6 OF 21 HCAPLUS COPYRIGHT 2006 ACS on STN  
AN 2003:913207 HCAPLUS  
DN 139:396487  
TI Sulfonated copolymer for polymer electrolyte membrane  
IN Cao, Shuguang; Xu, Helen; Chen, Jingping  
PA Polyfuel, Inc., USA  
SO PCT Int. Appl., 32 pp.

CODEN: PIXXD2

 DT Patent  
 LA English  
 FAN.CNT 6

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 2003095509	A1	20031120	WO 2003-US15178	20030513 <--
	W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW				
	RW: GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR, BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG				
	AU 2003237849	A1	20031111	AU 2003-237849	20030513 <--
	CA 2485727	AA	20031120	CA 2003-2485727	20030513 <--
	EP 1517929	A1	20050330	EP 2003-736609	20030513 <--
	R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO, MK, CY, AL, TR, BG, CZ, EE, HU, SK				
	CN 1668656	A	20050914	CN 2003-816349	20030513 <--
	JP 2006506472	T2	20060223	JP 2004-503520	20030513 <--
	US 2006135657	A1	20060622	US 2006-350228	20060207 <--
PRAI	US 2002-381136P	P	20020514	<--	
	US 2002-426540P	P	20021115		
	US 2003-446395P	P	20030210		
	US 2003-449299P	P	20030220		
	US 2003-438299	A3	20030513		
	WO 2003-US15178	W	20030513		

AB This invention relates to sulfonated copolymers for proton-conducting membranes allowing the dimensional stability of polymer electrolyte membrane over a wide temperature range and avoiding excessive membrane swelling in direct methanol fuel cells. The method for the preparation of a sulfonated polymers is included the steps of combining a first monomer having at least one sulfonate group and having at least two leaving groups with a second comonomer having at least two groups that can displace at least one leaving group of the first monomer and a third comonomer having at least two leaving groups, and a fourth comonomer having at least two displacing groups that can react with the leaving groups of either said first comonomer or said third comonomer and is used for proton exchange membranes, catalyst coated membranes and membrane electrode assembly preparation. Exemplified polymer is prepared by heating of the mixture of 9.13 g

of

bisphenol A, 5.67 g of 4,4'-difluorobenzophenone, 5.91 g of 4,4'-difluoro-3,3'-disulfonyl-benzophenone and 7.2 g of potassium carbonate in a mixture of DMSO and toluene at 150° for 4 h and keeping at at 180° for 6 h with further precipitation with acetone or methanol. The dry polymer is dissolved in DMAC for 20% coating solution and the obtained 2 mil thick membrane is soaked in sulfuric acid for 16 h.

IC ICM C08F0016-36  
 CC 37-3 (Plastics Manufacture and Processing)  
 Section cross-reference(s): 52  
 IT Fuel cell electrolytes

# **Membranes, nonbiological**

(sulfonated copolymer for polymer electrolyte membrane)

IT 625392-07-6P 625392-08-7P 625392-10-1P 625392-12-3P 625392-14-5P  
 625392-16-7P 625392-17-8P 625392-19-0P 625392-21-4P  
 625392-23-6P 625392-25-8P 625392-26-9P 625392-28-1P



625392-30-5P 625392-32-7P 625392-35-0P 625392-38-3P  
 RL: DEV (Device component use); IMF (Industrial manufacture); TEM  
 (Technical or engineered material use); PREP (Preparation); USES (Uses)  
 (sulfonated copolymer for polymer electrolyte membrane)

IT **625392-17-8P 625392-19-0P 625392-23-6P**  
 RL: DEV (Device component use); IMF (Industrial manufacture); TEM  
 (Technical or engineered material use); PREP (Preparation); USES (Uses)  
 (sulfonated copolymer for polymer electrolyte membrane)

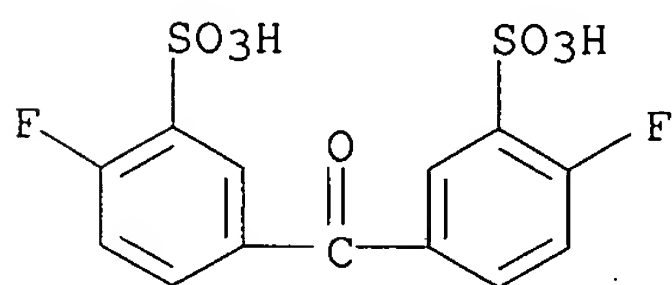
RN 625392-17-8 HCAPLUS

CN Benzenesulfonic acid, 3,3'-carbonylbis[6-fluoro-, polymer with  
 bis(4-fluorophenyl)methanone and 4,4'-cyclohexylidenebis[phenol] (9CI)  
 (CA INDEX NAME)

CM 1

CRN 625392-06-5

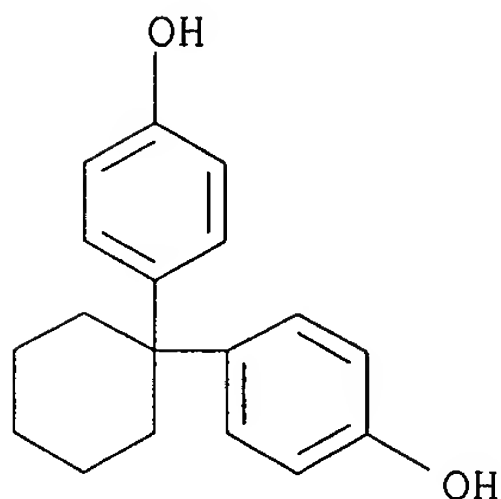
CMF C13 H8 F2 O7 S2



CM 2

CRN 843-55-0

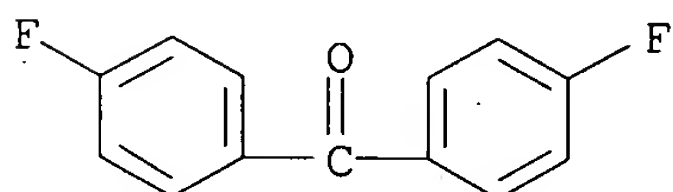
CMF C18 H20 O2



CM 3

CRN 345-92-6

CMF C13 H8 F2 O



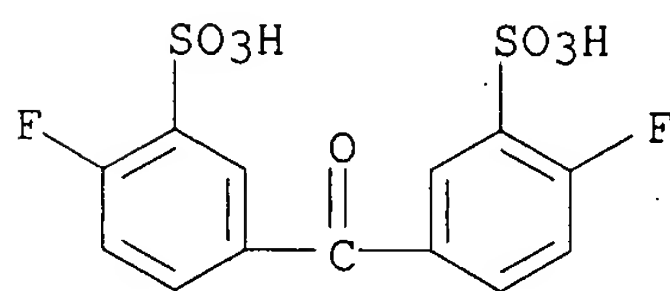
RN 625392-19-0 HCAPLUS

CN Benzenesulfonic acid, 3,3'-carbonylbis[6-fluoro-, polymer with  
4,4'-cyclohexylidenebis[phenol] and 1,1'-sulfonylbis[4-fluorobenzene]  
(9CI) (CA INDEX NAME)

CM 1

CRN 625392-06-5

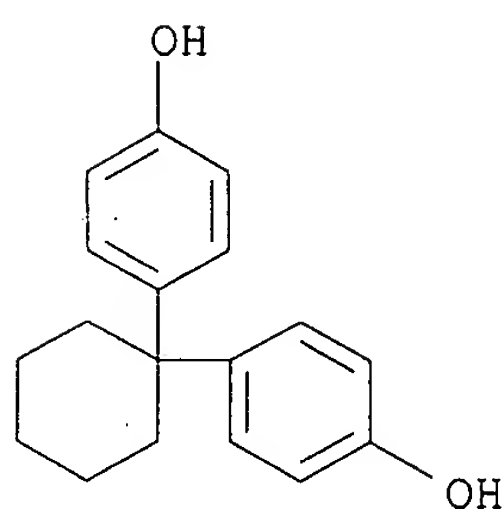
CMF C13 H8 F2 O7 S2



CM 2

CRN 843-55-0

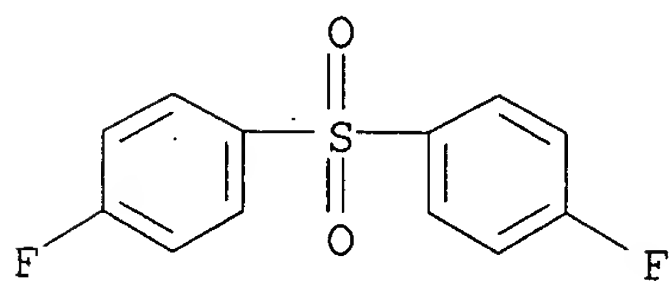
CMF C18 H20 O2



CM 3

CRN 383-29-9

CMF C12 H8 F2 O2 S



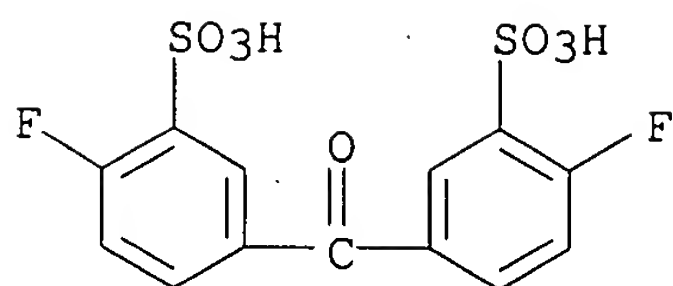
RN 625392-23-6 HCAPLUS

CN Benzenesulfonic acid, 3,3'-carbonylbis[6-fluoro-, polymer with  
bis(4-fluorophenyl)methanone and 4,4'-(9H-fluoren-9-ylidene)bis[phenol]  
(9CI) (CA INDEX NAME)

CM 1

CRN 625392-06-5

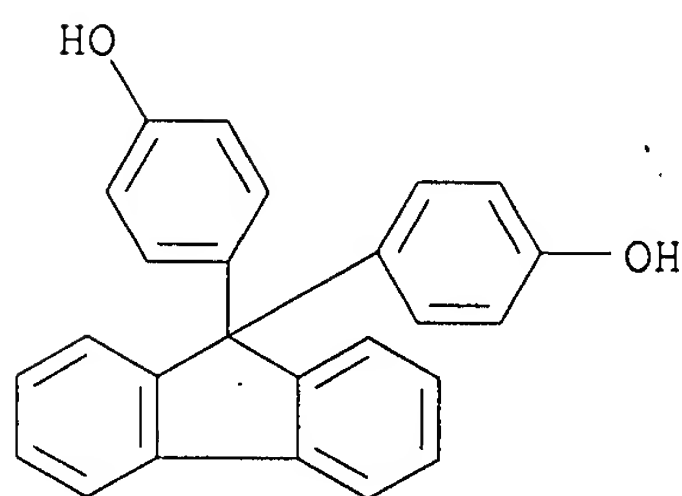
CMF C13 H8 F2 O7 S2



CM 2

CRN 3236-71-3

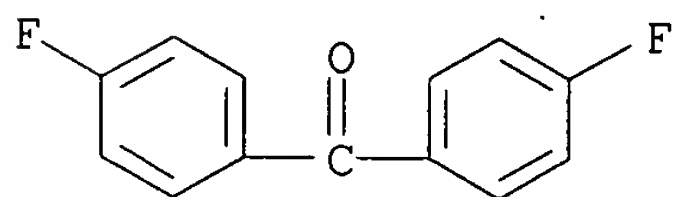
CMF C25 H18 O2



CM 3

CRN 345-92-6

CMF C13 H8 F2 O



## RETABLE

Referenced Author (RAU)	Year (RPY)	VOL (RVL)	PG (RPG)	Referenced Work (RWK)	Referenced File
Gan	2001	50	1812	Polymer International	HCAPLUS
Liu	2001	222	579	Macromol Rapid Commu	
Liu	2001	42	3293	Polymer	HCAPLUS
McGrath	2002			US 20020091225 A1	
Wang	1998	199	1421	Macromol Chem Phys	HCAPLUS
Xiao	2002	48	309	Polymer Bulletin	HCAPLUS

L95 ANSWER 7 OF 21 HCAPLUS COPYRIGHT 2006 ACS on STN

AN 2003:907123 HCAPLUS

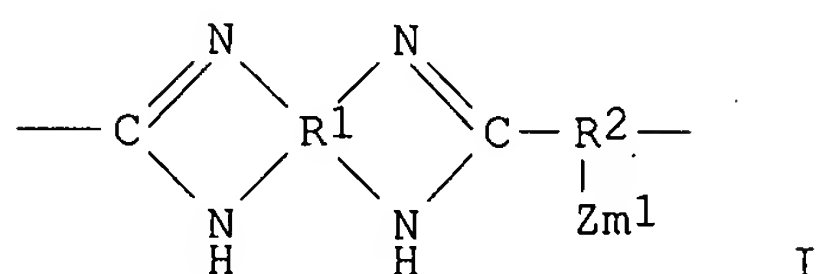
DN 139:382455

TI Compositions containing acidic group-containing polybenzimidazoles and acidic group-containing polymers for adhesives and ion conductor membranes used in electrode composites of fuel cells

IN Sakaguchi, Yoshimitsu; Kitamura, Kota; Nagahara,

**Shigenori**  
 PA **Toyobo Co., Ltd., Japan**  
 SO Jpn. Kokai Tokkyo Koho, 14 pp.  
 CODEN: JKXXAF  
 DT Patent  
 LA Japanese  
 FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 2003327825	A2	20031119	JP 2002-133112	20020508 <--
PRAI	JP 2002-133112		20020508	<--	
GI					



AB The compns. giving polymer electrolyte membranes with high ion conductivity while suppressing swelling in high-temperature humid state, comprise polybenzimidazoles having structural components I (m1 = 1-4; R1 = imidazole ring-forming tetravalent aromatic linkage; R2 = divalent aromatic linkage; R1 and R2 may be single aromatic ring or linked residue or condensed ring of plural aromatic rings optionally with stable substituent; Z = sulfonic acid and/or phosphonic acid residue optionally with partial salt structure) and acidic group-containing polymers. Thus, a solution of polybenzimidazole prepared from 3,3',4,4'-tetraaminodiphenylsulfone and 2,5-dicarboxybenzenesulfonic acid monosodium salt was mixed with a solution of sulfonated 9,9-bis(4-hydroxyphenyl)fluorene-bis(4-hydroxyphenyl)sulfone-4,4'-difluorodiphenylsulfone copolymer to give a mixture, which was processed to give a film showing ion conductivity (80°, 95%RH) 0.07 S/cm.

IC ICM C08L0079-04  
 ICS C08L0101-06; C09J0179-04; H01B0001-06; H01M0008-02; H01M0008-10

CC 38-3 (Plastics Fabrication and Uses)  
 Section cross-reference(s): 52, 76

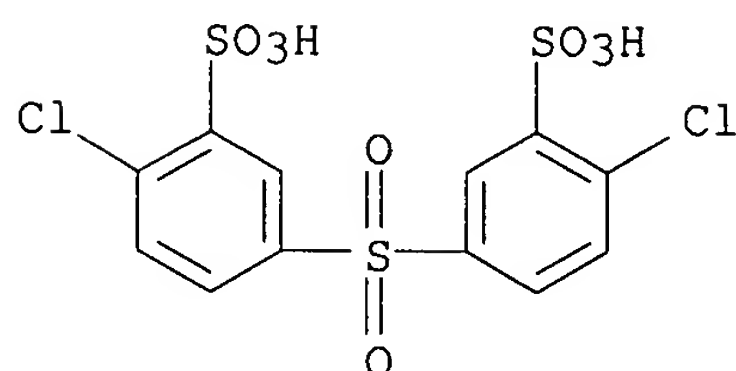
IT **267877-35-0P** 425636-38-0P, 2,5-Dicarboxybenzenesulfonic acid monosodium salt-3,3',4,4'-tetraaminodiphenylsulfone copolymer 426255-33-6P  
 RL: IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
 (compns. containing acidic group-containing polybenzimidazoles and acidic group-containing polymers for fuel cell ion conductor membranes and adhesives)

IT **267877-35-0P**  
 RL: IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
 (compns. containing acidic group-containing polybenzimidazoles and acidic group-containing polymers for fuel cell ion conductor membranes and adhesives)

RN 267877-35-0 HCAPLUS  
 CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, disodium salt, polymer with [1,1'-biphenyl]-4,4'-diol and 1,1'-sulfonylbis[4-chlorobenzene] (9CI)  
 (CA INDEX NAME)

CM 1

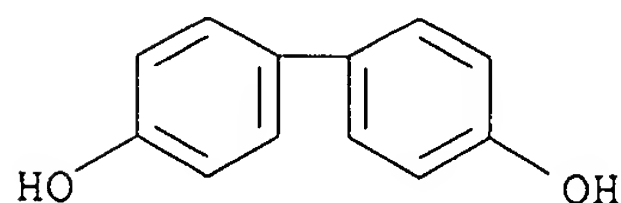
CRN 51698-33-0  
CMF C12 H8 Cl2 O8 S3 . 2 Na



● 2 Na

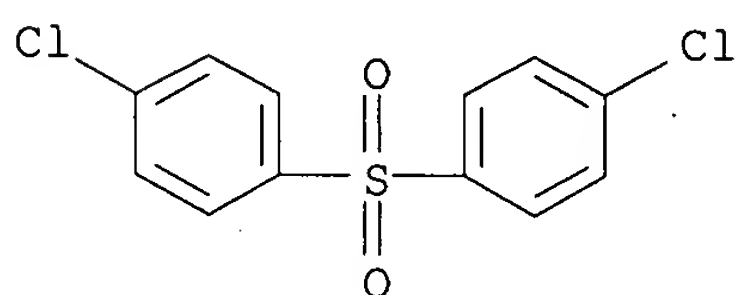
CM 2

CRN 92-88-6  
CMF C12 H10 O2



CM 3

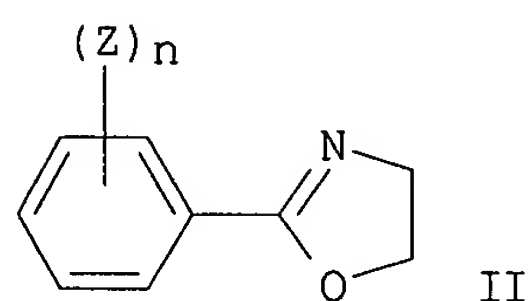
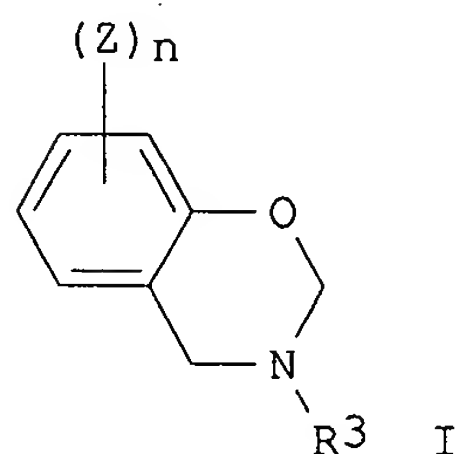
CRN 80-07-9  
CMF C12 H8 Cl2 O2 S



L95 ANSWER 8 OF 21 HCAPLUS COPYRIGHT 2006 ACS on STN  
AN 2003:586587 HCAPLUS  
DN 139:152288  
TI Thermally crosslinkable polymer solid electrolyte for fuel cell, polymer  
solid electrolyte film, and manufacture thereof  
IN Kitamura, Kota; Takase, Satoshi; Sakaguchi,  
Yoshimitsu; Nagahara, Shigenori; Hamamoto, Shiro;  
Nakao, Junko  
PA Toyobo Co., Ltd., Japan  
SO Jpn. Kokai Tokkyo Koho, 9 pp.  
CODEN: JKXXAF  
DT Patent  
LA Japanese

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 2003217343	A2	20030731	JP 2002-15987	20020124 <--
PRAI	JP 2002-15987		20020124	<--	
GI					



AB The thermally crosslinkable polymer solid electrolyte has  $\geq 1$  ionic group and  $\geq 1$  thermally crosslinkable group in the mol. The ionic group may be sulfonic acid or phosphonic acid group. Thermally crosslinkable group may be  $-C_6H_4(Z)_n-C.tplbond.R_1$ ,  $-C_6H_4(Z)_n-OCH_2-C.tplbond.R_2$ , I  $-C_6H_4(Z)_n-CR_6=CR_4R_5$ ,  $CH_2-CR_9=CR_8R_7$ , or II ( $Z = mH$ ,  $C_{12-10}$  hydrocarbon, halo, etc.;  $R_1-9 = H$ ,  $C_{1-10}$  alkyl, Ph, etc.;  $X = H$ , monovalent metal ion; and  $n = \text{integer } 1-4$ ). The polymer backbone chain may be polyethersulfone or polyether ketone.

IC ICM H01B0001-06  
ICS C08G0065-40; C08G0075-23; C08J0005-22; H01B0013-00; H01M0008-02; H01M0008-10

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 35, 38

IT **569346-21-ODP**, Disodium 4,4'-dichlorodiphenylsulfone-3,3'-disulfonate-4,4'-dichlorodiphenylsulfone-biphenol copolymer, reaction product with 4-ethynylphenol  
RL: PNU (Preparation, unclassified); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
(crosslinked; thermally crosslinkable polymer solid electrolyte for fuel cell)

IT **569346-21-ODP**, Disodium 4,4'-dichlorodiphenylsulfone-3,3'-disulfonate-4,4'-dichlorodiphenylsulfone-biphenol copolymer, reaction product with 4-ethynylphenol  
RL: PNU (Preparation, unclassified); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
(crosslinked; thermally crosslinkable polymer solid electrolyte for fuel cell)

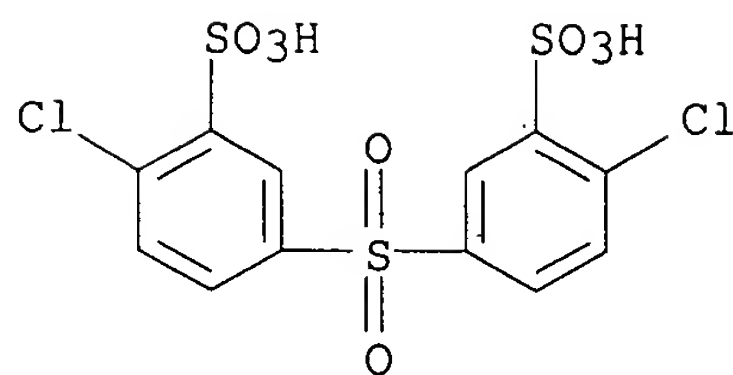
RN 569346-21-0 HCAPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, disodium salt, polymer with [1,1'-biphenyl]-ar,ar'-diol and 1,1'-sulfonylbis[4-chlorobenzene] (9CI) (CA INDEX NAME)

CM 1

CRN 51698-33-0

CMF C12 H8 Cl2 O8 S3 . 2 Na



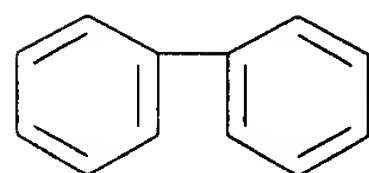
● 2 Na

CM 2

CRN 26983-52-8

CMF C12 H10 O2

CCI IDS

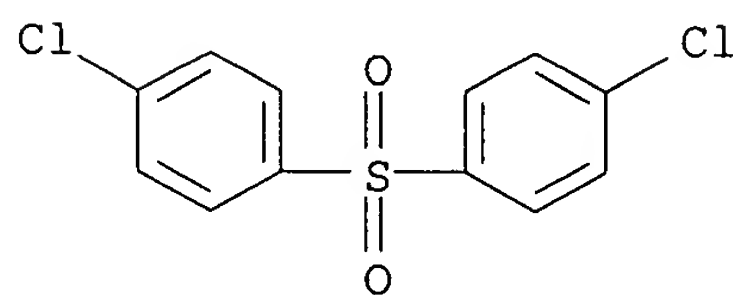


2 ( D1-OH )

CM 3

CRN 80-07-9

CMF C12 H8 Cl2 O2 S



L95 ANSWER 9 OF 21 HCAPLUS COPYRIGHT 2006 ACS on STN  
 AN 2003:319959 HCAPLUS  
 DN 138:339060  
 TI Crosslinkable aromatic resins having protonic acid groups, and ion  
 conductive polymer membranes, binders, and fuel cells made by using the  
 same  
 IN Ishikawa, Junichi; Kuroki, Takashi; Fujiyama, Satoko; Omi, Takehiko;  
 Nakata, Tomoyuki; Okawa, Yuichi; Miyazaki, Kazuhisa; Fujii, Shigeharu;  
 Tamai, Shoji  
 PA Mitsui Chemicals, Inc., Japan  
 SO PCT Int. Appl., 132 pp.  
 CODEN: PIXXD2



DT Patent  
LA Japanese  
FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 2003033566	A1	20030424	WO 2002-JP10536	20021010 <--
	W: CA, CN, IN, JP, KR, US				
	RW: DE, FR, GB, IT, SE				
	TW 236486	B1	20050721	TW 2002-91123279	20021009 <--
	CA 2463429	AA	20030424	CA 2002-2463429	20021010 <--
	EP 1457511	A1	20040915	EP 2002-775319	20021010 <--
	R: DE, FR, GB, IT, SE, SI, LT, LV, RO, MK, AL				
	CN 1630676	A	20050622	CN 2002-820224	20021010 <--
	US 2004191602	A1	20040930	US 2004-820842	20040409 <--
PRAI	JP 2001-312799	A	20011010	<--	
	JP 2002-182252	A	20020621	<--	
	WO 2002-JP10536	W	20021010	<--	

AB The invention relates to (A) a crosslinkable aromatic resin which has crosslinking groups and protonic acid groups and is suitable for electrolyte membranes and binders for fuel cells, (B) polymeric electrolyte membranes and binders for fuel cells, made by using the resin, and (C) fuel cells made by using the membranes or the binders. The aromatic resin has crosslinking groups which are not derived from protonic acid groups and are capable of causing crosslinking without the formation of a leaving component, and exhibits excellent ionic conductivity, heat resistance, water resistance, and adhesion, and low methanol permeability. It is preferable that the aromatic resin bears as the crosslinking groups both C1-10 alkyl bonded directly to an aromatic ring and carbonyl or carbon-carbon double or triple bonds, while preferred examples of the crosslinkable aromatic resin include aromatic polyether, aromatic polyamide, aromatic polyimide, aromatic polyamide-imide, and aromatic polyazole, each of which has crosslinking

groups described above. Thus, 5,5'-carbonylbis(sodium 2-fluorobenzenesulfonate) obtained from 0.525 mol 4,4'-difluorobenzophenone and 210 mL 50% sulfuric acid 4.22, 4,4'-difluorobenzophenone 2.18, and 2,2-bis(3,5-dimethyl-4-hydroxyphenyl)propane 5.69 g were reacted at 160° for 4 h in the presence of potassium carbonate to give 10.39 g polyether ketone powder with reduced viscosity 0.85 dL/g, glass transition temperature 230°, and 5% weight loss temperature 367°, which was applied on a glass and dried at 200° for 4 h to give a membrane with conductivity 0.018 S/cm at 30° and 0.065 S/cm at 90°.

IC ICM C08G0065-40  
ICS C08G0069-48; C08G0073-10; C08J0005-22; H01M0008-02  
CC 37-3 (Plastics Manufacture and Processing)  
Section cross-reference(s): 38, 52

IT **Membranes, nonbiological**

(ionic conductive; preparation of crosslinkable aromatic resins having protonic acid groups for ion conductive polymer membranes, binders, and fuel cells)

IT 24938-67-8DP, Poly(2,6-dimethyl-1,4-phenylene oxide), sodium sulfonated **267877-35-ODP**, reaction products with ethenylphenol 515144-25-9P  
515144-26-0P 515144-27-1P 515144-28-2P 515144-29-3P 515144-30-6P  
515144-31-7P 515144-32-8P 515144-33-9P 515144-60-2P 515144-61-3P  
515144-62-4P 515144-64-6DP, sulfonated 515144-65-7DP, sulfonated  
515811-98-0P  
RL: IMF (Industrial manufacture); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

for (preparation of crosslinkable aromatic resins having protonic acid groups  
ion conductive polymer membranes, binders, and fuel cells)

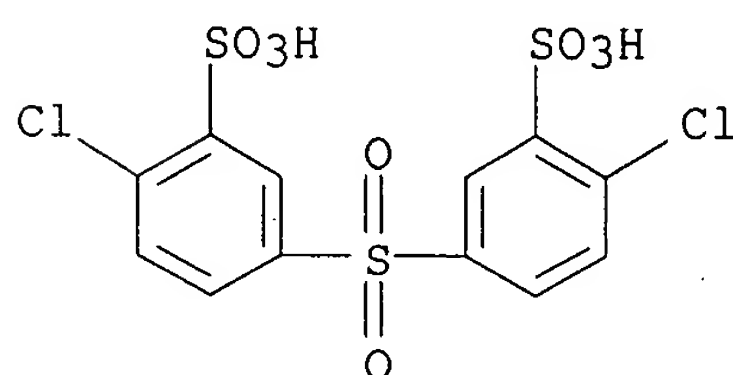
IT 267877-35-0DP, reaction products with ethenylphenol  
RL: IMF (Industrial manufacture); PRP (Properties); TEM (Technical or  
engineered material use); PREP (Preparation); USES (Uses)  
for (preparation of crosslinkable aromatic resins having protonic acid groups  
ion conductive polymer membranes, binders, and fuel cells)

RN 267877-35-0 HCAPLUS  
CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, disodium salt, polymer  
with [1,1'-biphenyl]-4,4'-diol and 1,1'-sulfonylbis[4-chlorobenzene] (9CI)  
(CA INDEX NAME)

CM 1

CRN 51698-33-0

CMF C12 H8 C12 O8 S3 . 2 Na

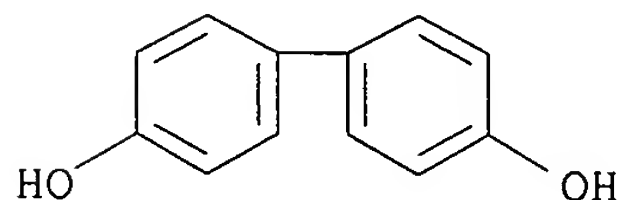


● 2 Na

CM 2

CRN 92-88-6

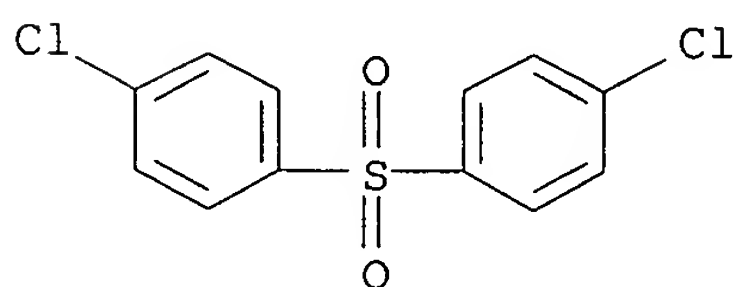
CMF C12 H10 O2



CM 3

CRN 80-07-9

CMF C12 H8 C12 O2 S



## RETABLE

Referenced Author (RAU)	Year (RPY)	VOL (RVL)	PG (RPG)	Referenced Work (RWK)	Referenced File
Commissariat A L'Energi	2001			WO 0125312 A	HCAPLUS
Commissariat A L'Energi	2001			JP 2000510511 A	
Commissariat A L'Energi	2001			US 200120082 A	
Commissariat A L'Energi	2001			FR 2799198 A	HCAPLUS
Hoechst Ag	1999			JP 11-502245 A	
Hoechst Ag	1999			WO 9629359 A	HCAPLUS
Kaneka Corp	2002			JP 2002105199 A	HCAPLUS
Kaneka Corp	2002			JP 2002121281 A	HCAPLUS
Sumitomo Electric Indus	2002			JP 2002358978 A	HCAPLUS
Sumitomo Electric Indus	2002			JP 2002367627 A	HCAPLUS
Victrex Manufacturing L	2000			WO 0015691 A	HCAPLUS
Victrex Manufacturing L	2000			JP 2002524631 A	

L95 ANSWER 10 OF 21 HCAPLUS COPYRIGHT 2006 ACS on STN

AN 2003:33836 HCAPLUS

DN 138:90987

TI Heat-resistant, ion-conductive aromatic polyethers and their moldings and films

IN Kitamura, Kota; Tatemori, Hiroshi; Sakaguchi, Yoshimitsu  
; Hamamoto, Shiro; Nakao, Junko; Takase, Satoshi

PA Toyobo Co., Ltd., Japan

SO Jpn. Kokai Tokkyo Koho, 8 pp.

CODEN: JKXXAF

DT Patent

LA Japanese

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 2003012795	A2	20030115	JP 2002-113686	20020416 <--
PRAI	JP 2001-126196	A	20010424	<--	

AB The aromatic polyethers, useful for polymer electrolytes, are prepared by polymerizing substantially equimolar blends of divalent phenols with dihalogenobenzenoid compds. in organic high-polar solvents in the presence of alkali metal **carbonates** and/or **bicarbonates**, wherein the polyethers have on o-position of ether bonds  $\geq 0.1$ -equivalent (on ether bonds) acidic groups and other substituents. Thus, 3,3'-disulfo-4,4'-dichlorodiphenyl sulfone disodium salt 2.456, 4,4'-dichlorodiphenyl sulfone 2.783, and 3,3'-dimethyl-4,4'-dihydroxydiphenyl sulfone 2.783 g were copolymd. at 190° in PhMe in the presence of K<sub>2</sub>CO<sub>3</sub> to give a polymer with intrinsic viscosity (0.5 g/dL NMP, 30°) 0.23 dL/g, T<sub>g</sub> 230°, and ion-exchange equivalent 1.43 mmol/g, water absorption of the film 31% after 1 days in distilled water at room temperature

IC ICM C08G0065-40

ICS C08J0005-00; C08L0071-08

CC 38-3 (Plastics Fabrication and Uses)

Section cross-reference(s): 52

IT Heat-resistant materials

**Ion exchange membranes**

(heat-resistant, ion-conductive aromatic polyethers and their moldings and films)

IT 483995-29-5P 483995-32-0P **483995-35-3P** 483995-39-7P

483995-42-2P 483995-45-5P 483995-47-7P 483995-50-2P

RL: IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

(heat-resistant, ion-conductive aromatic polyethers and their moldings and films)

IT 483995-35-3P

RL: IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

(heat-resistant, ion-conductive aromatic polyethers and their moldings and films)

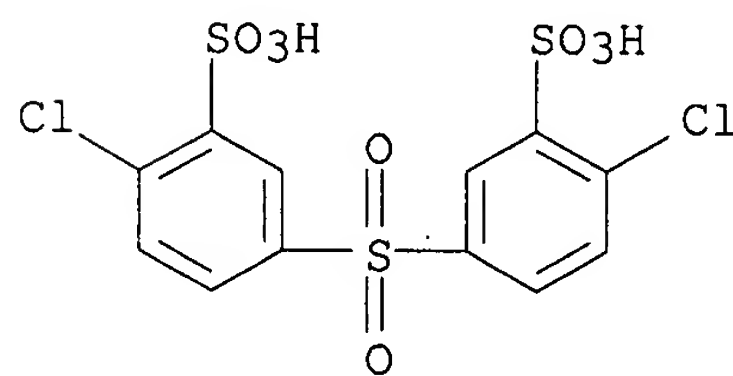
RN 483995-35-3 HCAPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, disodium salt, polymer with [1,1'-biphenyl]-4,4'-diol and 1,1'-sulfonylbis[3,4-dichlorobenzene] (9CI) (CA INDEX NAME)

CM 1

CRN 51698-33-0

CMF C12 H8 Cl2 O8 S3 . 2 Na

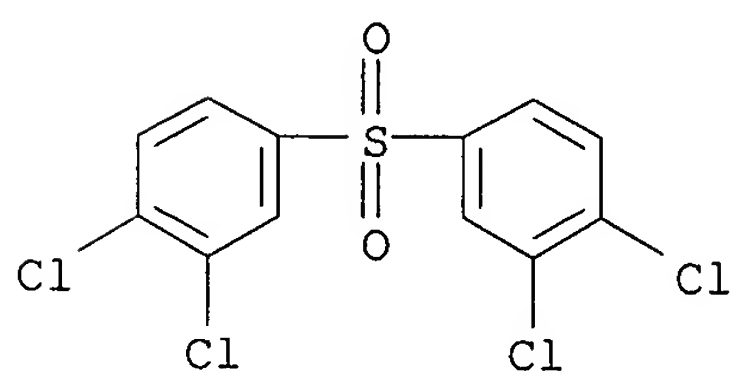


● 2 Na

CM 2

CRN 22588-79-0

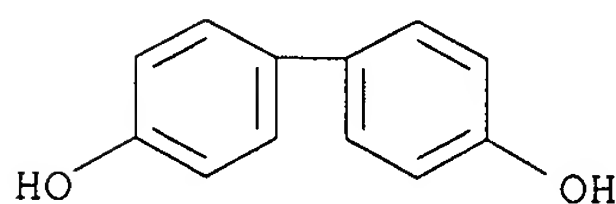
CMF C12 H6 Cl4 O2 S



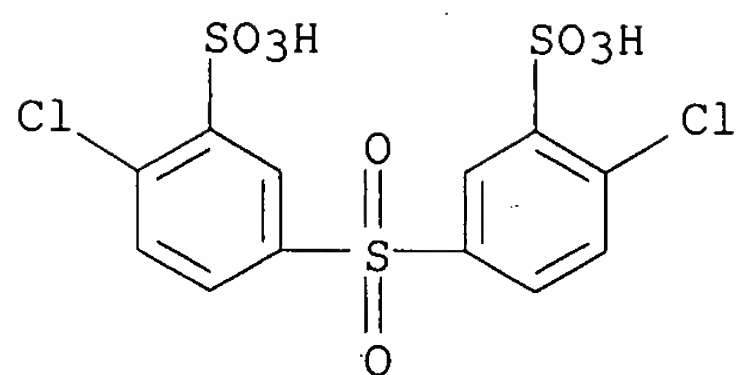
CM 3

CRN 92-88-6

CMF C12 H10 O2



L95 ANSWER 11 OF 21 HCAPLUS COPYRIGHT 2006 ACS on STN  
 AN 2002:281429 HCAPLUS  
 DN 137:79794  
 TI Proton exchange membrane nanocomposites  
 AU Hickner, Michael A.; Kim, YuSeung; Wang, Feng; McGrath, James E.;  
 Zawodzinski, Thomas A.  
 CS Department of Chemistry and Materials Research Institute, Virginia  
 Polytechnic Institute and State University, Blacksburg, VA, 24061, USA  
 SO Proceedings of the American Society for Composites, Technical Conference (2001), 16th, 323-336  
 CODEN: PAMTEG; ISSN: 1084-7243  
 PB CRC Press LLC  
 DT Journal; (computer optical disk)  
 LA English  
 AB Polymeric membrane nanocomposites incorporating phosphotungstic acid were synthesized as candidates for fuel cell proton exchange membranes. The matrix polymers for the nanocomposites were sulfonated poly(arylene ether sulfone)s. The main goal of this research is to improve upon purely polymeric proton exchange membranes and allow the fuel cell to be run at temps. greater than 100°C. The phosphotungstic acid serves to improve the protonic conductivity of the membrane while decreasing the water absorption. This is a surprising result, as with most sulfonic acid-base membranes, protonic conductivity has been directly related to membrane water content. In addition, the inorg. filler also improves the modulus of the material.  
 CC 38-3 (Plastics Fabrication and Uses)  
 Section cross-reference(s): 35, 37, 52  
 IT **Membranes, nonbiological**  
 (composite; proton exchange membrane nanocomposites of sulfonated poly(arylene ether sulfone)s/phosphotungstic acid)  
 IT **267877-35-ODP**, hydrolyzed  
 RL: POF (Polymer in formulation); PRP (Properties); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
 (proton exchange membrane nanocomposites of sulfonated poly(arylene ether sulfone)s/phosphotungstic acid)  
 IT **267877-35-ODP**, hydrolyzed  
 RL: POF (Polymer in formulation); PRP (Properties); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
 (proton exchange membrane nanocomposites of sulfonated poly(arylene ether sulfone)s/phosphotungstic acid)  
 RN 267877-35-0 HCAPLUS  
 CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, disodium salt, polymer with [1,1'-biphenyl]-4,4'-diol and 1,1'-sulfonylbis[4-chlorobenzene] (9CI) (CA INDEX NAME)  
 CM 1  
 CRN 51698-33-0  
 CMF C12 H8 Cl2 O8 S3 . 2 Na

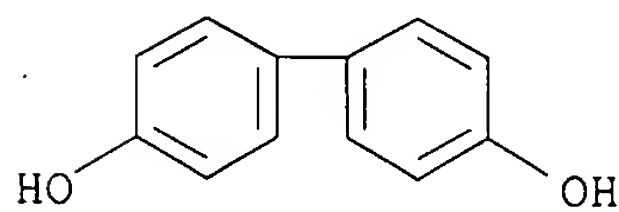


● 2 Na

CM 2

CRN 92-88-6

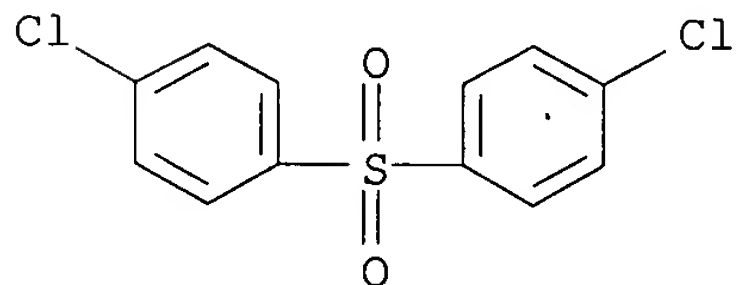
CMF C12 H10 O2



CM 3

CRN 80-07-9

CMF C12 H8 C12 O2 S



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Alberti, G	2001	185	73	J Memb Sci	HCAPLUS
Malhotra, S	1997	144	L23	J Electrochem Soc	HCAPLUS
Park, M	1996	64	743	Denki Kagaku	HCAPLUS
Savinell, R	1998	98-27	81	Electrochem Soc Proc	
Steck, A	1997			Presented at the New	
Thomas, S	1999			Fuel Cells - Green P	
Wang, F	2001			J Memb Sci, submitte	
Wang, F	2000			Macromol Symp, accep	
Zaidi, S	2000	173	17	J Memb Sci	HCAPLUS
Zawodzinski, T	1991	95	6040	J Phys Chem	HCAPLUS

L95 ANSWER 12 OF 21 HCAPLUS COPYRIGHT 2006 ACS on STN

AN 2002:241166 HCAPLUS

DN 136:265821

TI Ion-conducting sulfonated polymeric materials  
 IN McGrath, James E.; Hickner, Michael; Wang, Feng; Kim, Yu-Seung  
 PA Virginia Tech Intellectual Properties, Inc., USA  
 SO PCT Int. Appl., 46 pp.  
 CODEN: PIXXD2

DT Patent  
 LA English

FAN.CNT 2

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 2002025764	A1	20020328	WO 2001-US29293	20010920 <--
	W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW RW: GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW, AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR, BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG				
	CA 2421627	AA	20020328	CA 2001-2421627	20010920 <--
	AU 2001092804	A5	20020402	AU 2001-92804	20010920 <--
	EP 1327278	A1	20030716	EP 2001-973199	20010920 <--
	R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO, MK, CY, AL, TR				
	JP 2004509224	T2	20040325	JP 2002-528869	20010920 <--
PRAI	US 2000-234177P	P	20000920	<--	
	WO 2001-US29293	W	20010920	<--	

AB Sulfonated polymers are made by the direct polymerization of a sulfonated monomer

to form the sulfonated polymers. The types of sulfonated polymers may include polysulfones or polyimides. The sulfonated polymers can be formed into **membranes** that may be used in proton **exchange membrane** fuel cells or as **ion exchange membranes**. The **membranes** formed from the sulfonated polymers exhibit improved properties over that of Nafion. A heteropoly acid may be added to the sulfonated polymer to form a nanocomposite **membrane** in which the heteropoly acid is highly dispersed. The addition of a heteropoly acid to the sulfonated polymer increases the thermal stability of the **membrane**, enhances the conductivity above 100°, and reduces the water uptake of the **membrane**.

IC ICM H01M0008-10

ICS C08G0069-26; C08G0075-00

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

Section cross-reference(s): 37

ST fuel cell **membrane** sulfonated polymer heteropoly acid

nanocomposite; **ion exchange membrane**

sulfonated polymer heteropoly acid nanocomposite

IT **Ion exchange membranes**

(ion-conducting sulfonated polymeric materials)

IT Fuel cells

(proton **exchange membrane**; ion-conducting sulfonated polymeric materials)

IT **267877-35-0P** 302924-87-4DP, proton exchanged derivs.  
302924-87-4P

RL: DEV (Device component use); SPN (Synthetic preparation); TEM  
 (Technical or engineered material use); PREP (Preparation); USES (Uses)  
 (ion-conducting sulfonated polymeric materials)

IT **267877-35-0P**

RL: DEV (Device component use); SPN (Synthetic preparation); TEM



(Technical or engineered material use); PREP (Preparation); USES (Uses)  
(ion-conducting sulfonated polymeric materials)

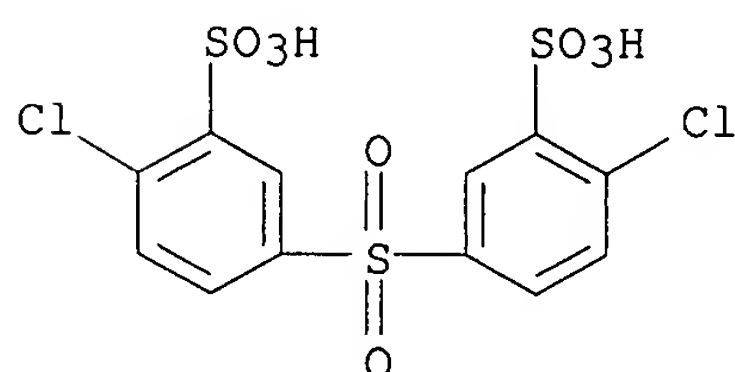
RN 267877-35-0 HCAPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, disodium salt, polymer  
with [1,1'-biphenyl]-4,4'-diol and 1,1'-sulfonylbis[4-chlorobenzene] (9CI)  
(CA INDEX NAME)

CM 1

CRN 51698-33-0

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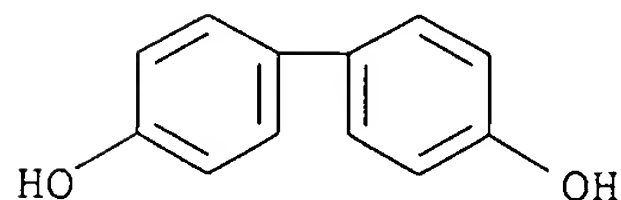


● 2 Na

CM 2

CRN 92-88-6

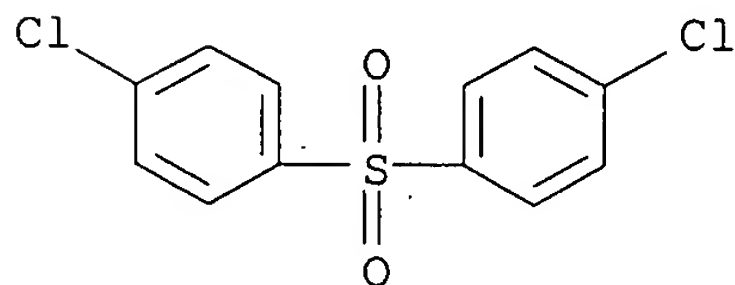
CMF C12 H10 O2



CM 3

CRN 80-07-9

CMF C12 H8 Cl2 O2 S



# RETABLE

Referenced Author (RAU)	Year (RPY)	VOL (RVL)	PG (RPG)	Referenced Work (RWK)	Referenced File
Aisin Aw Co Ltd	1997			JP 09245818	HCAPLUS
Mecham, J	2000	41	1388	Polym Prepr	HCAPLUS



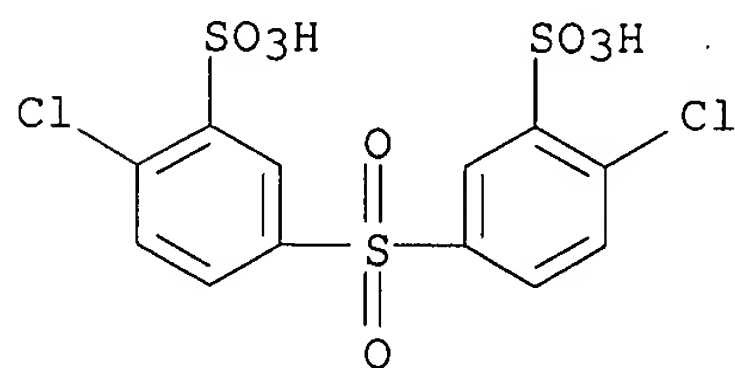
Miller | 1993 | | | US 5272217 A | HCAPLUS

L95 ANSWER 13 OF 21 HCAPLUS COPYRIGHT 2006 ACS on STN  
 AN 2002:230184 HCAPLUS  
 DN 137:20681  
 TI Synthesis and characterization of controlled molecular weight poly(arylene ether sulfone) copolymers bearing sulfonate groups by end-group analysis  
 AU Wang, Feng; Glass, Thomas; Li, Xinyu; Hickner, Michael; Kim, YuSeung; McGrath, James  
 CS Dep. Chem. Material Inst., Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, 24061, USA  
 SO Polymer Preprints (American Chemical Society, Division of Polymer Chemistry) (2002), 43(1), 492-493  
 CODEN: ACPPAY; ISSN: 0032-3934  
 PB American Chemical Society, Division of Polymer Chemistry  
 DT Journal; (computer optical disk)  
 LA English  
 AB Copolymer of 4,4'-biphenol 4,4'-dichlorodiphenyl sulfone 3,3'-disulfonated 4,4'-dichlorodiphenyl sulfone was end-capped with 4-tert-butylphenol. The mol. weight and chemical composition characterization of sulfonated poly(arylene ether sulfone)s by the combination of quant. end capping and NMR techniques.  
 CC 35-5 (Chemistry of Synthetic High Polymers)  
 IT 98-54-4DP, 4-tert-Butylphenol, reaction product with 4,4'-biphenol-4,4'-dichlorodiphenyl sulfone-3,3'-disulfonated 4,4'-dichlorodiphenyl sulfone copolymer **267877-35-ODP**, reaction product with 4-tert-Butylphenol  
 RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation) (synthesis and characterization of controlled mol. weight poly(arylene ether sulfone) copolymers bearing sulfonate groups by end-group anal.)  
 IT **267877-35-ODP**, reaction product with 4-tert-Butylphenol  
 RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation) (synthesis and characterization of controlled mol. weight poly(arylene ether sulfone) copolymers bearing sulfonate groups by end-group anal.)  
 RN 267877-35-0 HCAPLUS  
 CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, disodium salt, polymer with [1,1'-biphenyl]-4,4'-diol and 1,1'-sulfonylbis[4-chlorobenzene] (9CI) (CA INDEX NAME)

CM 1

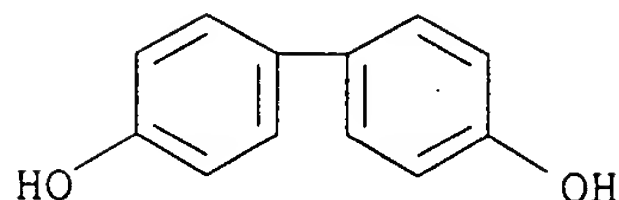
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CMF C12 H8 Cl2 O8 S3 . 2 Na

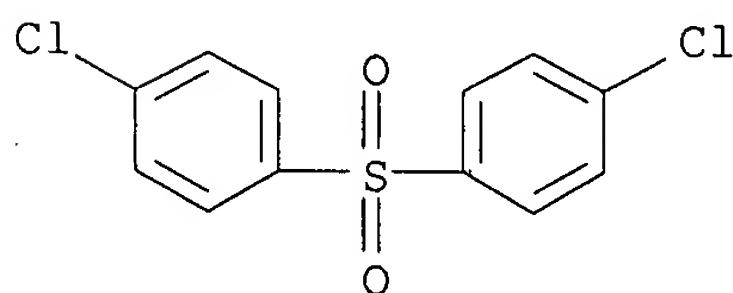


● 2 Na

CM 2

 CRN 92-88-6  
 CMF C12 H10 O2


CM 3

 CRN 80-07-9  
 CMF C12 H8 Cl2 O2 S


## RETABLE

Referenced Author (RAU)	Year (RPY)	VOL (RVL)	PG (RPG)	Referenced Work (RWK)	Referenced File
Dumais, J	1986	19	1884	Macromolecules	HCAPLUS
Gary, F	1997			Polymer Electrolytes	
Gunduz, N	2001			Ph D Thesis, Virginia	
Jurek, M	1989	30	978	Polymer	
McGrath, J	1981		327	ACS Symposium Series	
McGrath, J	1984	22	721	J of Polym Sci	
McGrath, J	1983	1	347	Physicochemical Aspe	
Noshay, A	1976	20	1885	J of Appl Polym Sci	HCAPLUS
Wang, F	2001			J of Membr Sci, in p	
Wang, F	1998	199	1421	Macromol Chem and Ph	HCAPLUS
Wang, F	2001			Macromolecular Sympo	
Wang, F	1999	40	795	Polymer	HCAPLUS
Wang, F	2000	41	1401	Polymer Preprint	HCAPLUS
Wang, F	2000	41	237	Polymer preprints	HCAPLUS
Wang, F	2001	85	517	Polymeric Materials:	HCAPLUS
Wang, F	2001	84	913	Polymeric Materials:	HCAPLUS

L95 ANSWER 14 OF 21 HCAPLUS COPYRIGHT 2006 ACS on STN

AN 2002:93463 HCAPLUS

DN 136:310780

 TI Direct polymerization of sulfonated poly(arylene ether sulfone) random  
 (statistical) copolymers: candidates for new proton exchange membranes

 AU Wang, Feng; Hickner, Michael; Kim, Yu Seung; Zawodzinski, Thomas A.;  
 McGrath, James E.

 CS Department of Chemistry and Materials Research Institute, Virginia  
 Polytechnic Institute and State University, Blacksburg, VA, 24061, USA

SO Journal of Membrane Science (2002), 197(1-2), 231-242

CODEN: JMESDO; ISSN: 0376-7388

PB Elsevier Science B.V.

DT Journal  
 LA English  
 AB Novel biphenol-based wholly aromatic poly(arylene ether sulfone)s containing up to two pendant sulfonate groups per repeat unit were prepared by potassium **carbonate** mediated direct aromatic nucleophilic substitution polycondensation of disodium 3,3'-disulfonate-4,4'-dichlorodiphenylsulfone (SDCDPS), 4,4'-dichlorodiphenylsulfone (DCDPS) and 4,4'-biphenol. Copolymn. proceeded quant. to high mol. weight in N-methyl-2-pyrrolidinone at 190 °C. Tough **membranes** with a SDCDPS/DCDPS mole ratio up to 60:40 were successfully cast using N,N-dimethylactamide. An increase of sulfonate groups in the copolymer resulted in increased glass transition temperature, enhanced **membrane** hydrophilicity, and intrinsic viscosity; the 100% SDCDPS homopolymer was water soluble. The acid form **membranes** were successfully obtained by treating the sodium form of the **membranes** with dilute sulfuric acid solution. Thermogravimetric anal. shows that the sodium form materials have enhanced thermal stability relative to the acid form, as expected. Atomic force microscopy (AFM) phase images of the acid form **membranes** clearly show the hydrophilic domains, with sizes increasing from 10 to 25 nm as a function of the degree of sulfonation. A phase inversion could be observed for the 60% SCDPS copolymer, which was consistent with a rapid increase in water absorption. Short-term aging (30 min) indicates that the desired acid form **membranes** are stable to 220 °C in air and conductivity values at 30 °C of 0.11 S/cm (SDCDPS/DCDPS=0.4) and 0.17 S/cm (SDCDPS/DCDPS=0.6) were measured, which are comparable to or higher than the state-of-the-art fluorinated copolymer Nafion 1135 control (0.12 S/cm). The conductivity is greatly influenced by **ion exchange** capacity, temperature, and water activity. The new copolymers, which contain **ion** conductivity sites on the deactivated positions of the aryl backbone rings, are candidates as new polymeric electrolyte materials for proton **exchange membrane** (PEM) fuel cells.

CC 38-3 (Plastics Fabrication and Uses)  
 Section cross-reference(s): 35

ST nucleophilic substitution polycondensation disodium  
 disulfonatodichlorodiphenylsulfone dichlorodiphenylsulfone biphenol  
 potassium **carbonate**; polyether polysulfone membrane prepn

IT Electric conductivity  
 Glass transition temperature  
**Membranes, nonbiological**  
 Thermal stability  
 Viscosity  
 (preparation, thermal, elec., and rheolog. properties of sulfonated poly(arylene ether sulfone) as candidates for new proton exchange membranes)

IT **584-08-7, Potassium carbonate**  
 RL: CAT (Catalyst use); USES (Uses)  
 (preparation, thermal, elec., and rheolog. properties of sulfonated poly(arylene ether sulfone) as candidates for new proton exchange membranes)

IT **267877-35-0P**  
 RL: PRP (Properties); RCT (Reactant); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); RACT (Reactant or reagent); USES (Uses)  
 (preparation, thermal, elec., and rheolog. properties of sulfonated poly(arylene ether sulfone) as candidates for new proton exchange membranes)

IT **267877-35-0DP, hydrolyzed**  
 RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
 (preparation, thermal, elec., and rheolog. properties of sulfonated

poly(arylene ether sulfone) as candidates for new proton exchange membranes)

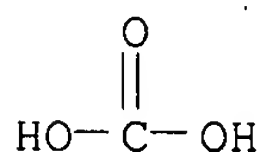
IT 584-08-7, Potassium **carbonate**

RL: CAT (Catalyst use); USES (Uses)

(preparation, thermal, elec., and rheolog. properties of sulfonated poly(arylene ether sulfone) as candidates for new proton exchange membranes)

RN 584-08-7 HCAPLUS

CN Carbonic acid, dipotassium salt (8CI, 9CI) (CA INDEX NAME)



●2 K

IT 267877-35-0P

RL: PRP (Properties); RCT (Reactant); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); RACT (Reactant or reagent); USES (Uses)

(preparation, thermal, elec., and rheolog. properties of sulfonated poly(arylene ether sulfone) as candidates for new proton exchange membranes)

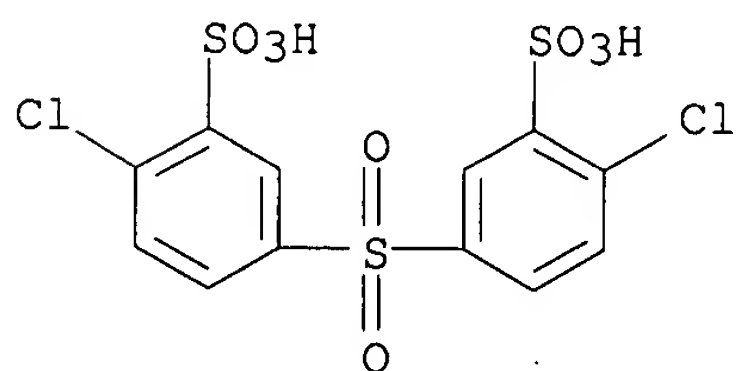
RN 267877-35-0 HCAPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, disodium salt, polymer with [1,1'-biphenyl]-4,4'-diol and 1,1'-sulfonylbis[4-chlorobenzene] (9CI) (CA INDEX NAME)

CM 1

CRN 51698-33-0

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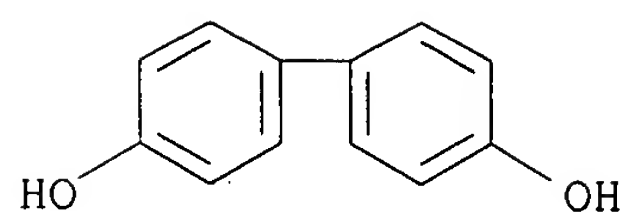


●2 Na

CM 2

CRN 92-88-6

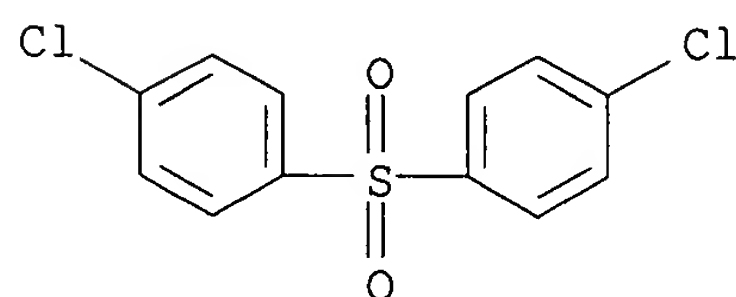
CMF C12 H10 O2



CM 3

CRN 80-07-9

CMF C12 H8 C12 O2 S



IT 267877-35-0DP, hydrolyzed

RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
(preparation, thermal, elec., and rheolog. properties of sulfonated poly(arylene ether sulfone) as candidates for new proton exchange membranes)

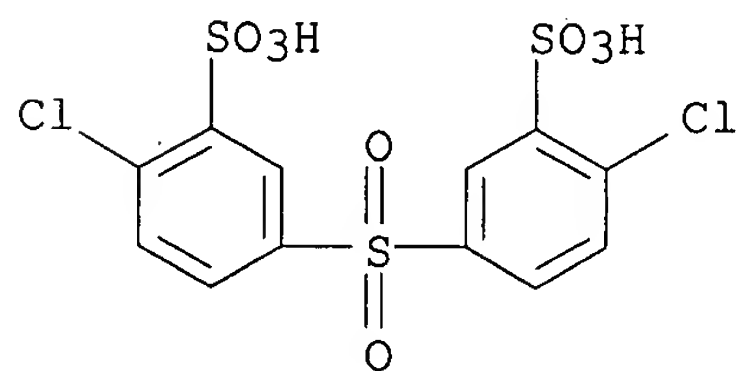
RN 267877-35-0 HCAPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, disodium salt, polymer with [1,1'-biphenyl]-4,4'-diol and 1,1'-sulfonylbis[4-chlorobenzene] (9CI)  
(CA INDEX NAME)

CM 1

CRN 51698-33-0

CMF C12 H8 C12 O8 S3 . 2 Na

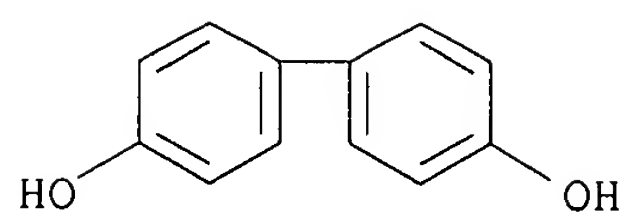


● 2 Na

CM 2

CRN 92-88-6

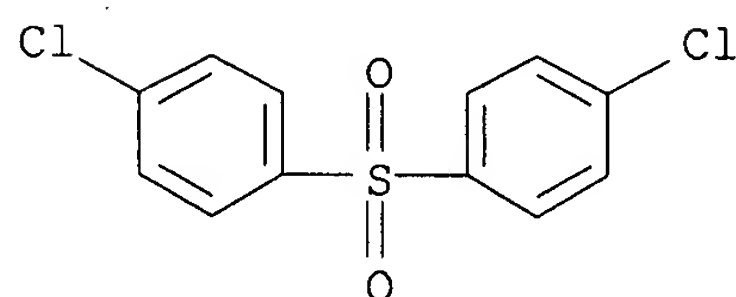
CMF C12 H10 O2



CM 3

CRN 80-07-9

CMF C12 H8 C12 O2 S



## RETABLE

Referenced Author (RAU)	Year (RPY)	VOL (RVL)	PG (RPG)	Referenced Work (RWK)	Referenced File
Appleby, A	1999		72	Sci Am	
Cotter, R	1995			A Handbook of Polymers	
Dinno, M	1983	1	347	Physicochemical Aspects	HCAPLUS
Dumais, J	1986	19	1884	Macromolecules	HCAPLUS
Genies, C	2001	42	359	Polymer	HCAPLUS
Gieke, T	1981	19	1687	J Polym Sci, Polym Phys	
Gunduz, N	2000	41	1565	Polym Preprints	HCAPLUS
Hedrick, J	1986	23	287	J Polym Sci, Polym Chem	
Jacoby, M	1999	77	31	C&E News	
Johnson, B	1984	22	721	J Polym Sci	HCAPLUS
Johnson, R	1967	5	2375	J Polym Sci, Polym Chem	HCAPLUS
Kerres, J	1996	34	2421	J Polym Sci	HCAPLUS
Kopitzke, R	2000	147	1667	J Electrochem Soc	
Leung, L	1987	28	20	Polym Commun	HCAPLUS
Lloyd, D	1981	152	327	ACS Symp Ser	
McGrath, J	1999			ACS Symp Ser	
Miyatake, K	1996	29	6969	Macromolecules	HCAPLUS
Noshay, A	1976	20	1885	J Appl Polym Sci	HCAPLUS
O'Gara, J	1987	25	1519	J Polym Sci Part B	HCAPLUS
Robeson, L	1983			US 4380598	HCAPLUS
Robeson, L	1978	4	405	Molecular Basis for	HCAPLUS
Sakurai, K	1993	26	208	Macromolecules	HCAPLUS
Shobha, H	2000	40	180	Polym Preprints	
Springer, T	1991	138	2334	J Electrochem Soc	HCAPLUS
Tran, C	1980			Thesis Virginia Poly	
Ueda, M	1993	31	85	J Polym Sci, Polym Chem	
Viswanathan, R	1984	25	1827	Polymer	HCAPLUS
Wang, F	1999	55	871	Acta Crystallogr, C	
Wang, F	1998	199	1421	Macromol Chem Phys	HCAPLUS
Wang, F	2001			Macromol Symp in pre	
Wang, F	2000	40	180	Polym Preprints	
Wang, F	2000	40	237	Polym Preprints	
Wang, F	1999	40	795	Polymer	HCAPLUS
Wang, S	2001			Review on Poly(aryle	

Xue, Y	1997	30	3803	Macromolecules	HCAPLUS
Zaidi, S	2000	173	17	J Membr Sci	HCAPLUS
Zawodzinski, T	1993	140	1981	J Electrochem Soc	HCAPLUS

L95 ANSWER 15 OF 21 HCAPLUS COPYRIGHT 2006 ACS on STN

AN 2001:846076 HCAPLUS

DN 136:102739

TI Synthesis of highly sulfonated poly(arylene ether sulfone) random (statistical) copolymers via direct polymerization

AU Wang, Feng; Hickner, Michael; Ji, Qing; Harrison, William; Mecham, Jeffrey; Zawodzinski, Thomas A.; McGrath, James E.

CS Department of Chemistry and Materials Research Institute (0344), Virginia Polytechnic Institute and State University, Blacksburg, VA, 24061, USA

SO Macromolecular Symposia (2001), 175(Polymerization Processes and Polymer Materials II), 387-395

CODEN: MSYMEC; ISSN: 1022-1360

PB Wiley-VCH Verlag GmbH

DT Journal

LA English

AB Novel biphenol-based wholly aromatic poly (arylene ether sulfones) containing pendant sulfonate groups were prepared by direct aromatic nucleophilic substitution polycondensation of disodium 3,3'-disulfonate-4,4'-dichlorodiphenyl sulfone (SDCDPS), 4,4'-dichlorodiphenylsulfone (DCDPS) and biphenol. Copolymn. proceeded quant. to high mol. weight in N-methyl-2-pyrrolidinone at 190°C in the presence of anhydrous potassium carbonate. Tough membranes were successfully cast from the control and the copolymers, which had a SDCDPS/DCDPS mole ratio of either 40:60 or 60:40 using N,N-dimethylactamide; the 100% SDCDPS homopolymer was water soluble. Short-term aging (30 min) indicates that the desired acid form membranes are stable to 220°C in air and conductivity values at 25°C of 0.110 (40%) and 0.170 S/cm (60%) were measured, which are comparable to or higher than the state-of-the art fluorinated copolymer Nafion 1135 control. The new copolymers, which contain ion conductivity sites on deactivated rings, are candidates as new polymeric electrolyte materials for proton exchange membrane (PEM) fuel cells. Further research comparing their membrane behavior to post-sulfonated systems is in progress.

CC 35-5 (Chemistry of Synthetic High Polymers)

IT 267877-35-ODP, reaction products with acids 389600-31-1DP, reaction products with acids

RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation) (synthesis of highly sulfonated poly(arylene ether sulfone) via direct polymerization)

IT 267877-35-ODP, reaction products with acids

RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation) (synthesis of highly sulfonated poly(arylene ether sulfone) via direct polymerization)

RN 267877-35-0 HCAPLUS

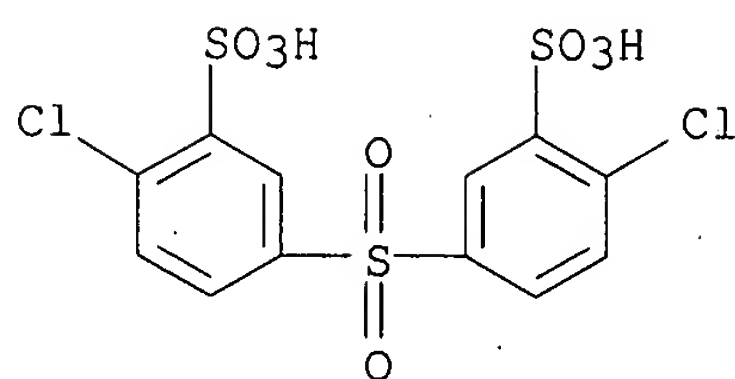
CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, disodium salt, polymer with [1,1'-biphenyl]-4,4'-diol and 1,1'-sulfonylbis[4-chlorobenzene] (9CI) (CA INDEX NAME)

CM 1

CRN 51698-33-0

CMF C12 H8 Cl2 O8 S3 . 2 Na



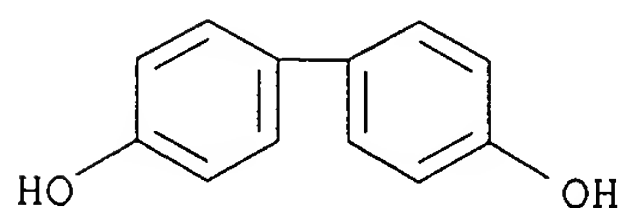


● 2 Na

CM 2

CRN 92-88-6

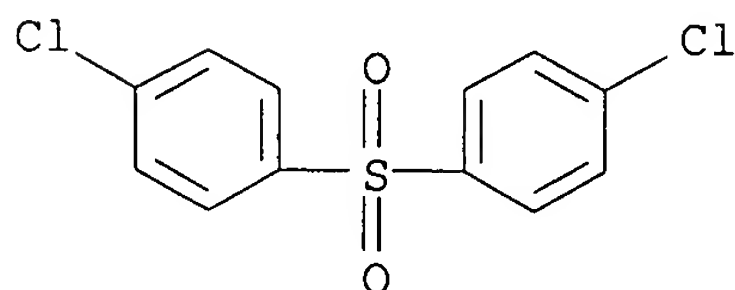
CMF C12 H10 O2



CM 3

CRN 80-07-9

CMF C12 H8 C12 O2 S



# RETABLE

Referenced Author (RAU)	Year (RPY)	VOL (RVL)	PG (RPG)	Referenced Work (RWK)	Referenced File
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Anon				Macromolecules in pr	
Applby, A	1999			Sci American	
Dinno, M	1983	1	347	Physicochemical Aspe	HCAPLUS
Dumais, J	1986	19	1884	Macromolecules	HCAPLUS
Gunduz, N	2000	41	1565	Polymer Preprints	HCAPLUS
Jacoby, M	1999	77	31	C&E News	
Johnson, B	1984	22	721	J of Polym Sci	HCAPLUS
Kopitzke, R	2000	147	1677	Journal of The Elect	HCAPLUS
Lloyd, D	1981		327	ACS Symposium Series	
McGrath, J	1999			ACS Symposium	
Mercier, R	1999			Fifth European Techn	
Noshay, A	1976	20	1885	J of Appl Polym Sci	HCAPLUS
Robeson, L	1983			US 4380598	HCAPLUS
Robeson, L	1978	4	405	Molecular Basis for	HCAPLUS



Shobha, H	2000	40	180	Polymer Preprints	
Springer, T	1991	138	2334	Journal of The Elect	HCAPLUS
Tran, C	1980			Thesis Virginia Poly	
Udea, M	1993	31	85	J Polym Sci, Polym C	
Wang, F	2000	40	180	Polymer Preprints	
Wang, F	2000	40	237	Polymer Preprints	

L95 ANSWER 16 OF 21 HCAPLUS COPYRIGHT 2006 ACS on STN

AN 2001:585306 HCAPLUS

DN 135:360132

TI Heteropolyacid/sulfonated poly(arylene ether sulfone) composites for proton exchange membranes fuel cells

AU Kim, Yu Seung; Wang, Feng; Hickner, Michael; Zawodzinski, Tom A.; McGrath, James E.

CS Department of Chemistry and Material Research Institute, Virginia Polytechnic Institute and State University, Blacksburg, VA, 24061, USA

SO Polymeric Materials Science and Engineering (2001), 85, 520-521

CODEN: PMSE DG; ISSN: 0743-0515

PB American Chemical Society

DT Journal

LA English

AB The preparation of composite membranes for use as proton exchange membranes in fuel cells at high temps. involves the incorporation of the solid heteropolyacid (hpa), H3PW12O40, in a poly(arylene ether sulfone) containing pendant sulfo groups. The poly(arylene ether sulfone) is prepared by reacting 4,4'-dichlorodiphenyl sulfone, 3,3'-diiodoisulfo-4,4'-dichlorodiphenyl sulfone and 4,4'-biphenol. The HPA extraction behavior, morphol., thermal and mech. properties, and proton conduction at elevated temperature of the composite membrane are discussed.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology) Section cross-reference(s): 35

IT **Membranes, nonbiological**

(composite; proton exchange membranes from heteropolyacid and sulfonated poly(arylene ether sulfone) for fuel cells)

IT **267877-35-ODP**, hydrolyzed

RL: SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

(composites, membranes; proton exchange membranes from heteropolyacid and sulfonated poly(arylene ether sulfone) for fuel cells)

IT **267877-35-ODP**, hydrolyzed

RL: SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

(composites, membranes; proton exchange membranes from heteropolyacid and sulfonated poly(arylene ether sulfone) for fuel cells)

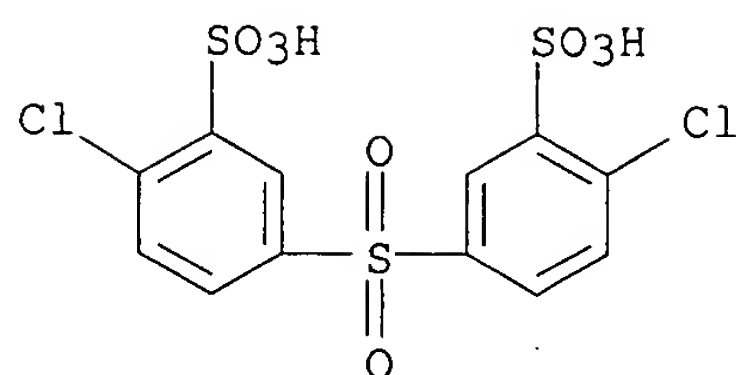
RN 267877-35-0 HCAPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, disodium salt, polymer with [1,1'-biphenyl]-4,4'-diol and 1,1'-sulfonylbis[4-chlorobenzene] (9CI) (CA INDEX NAME)

CM 1

CRN 51698-33-0

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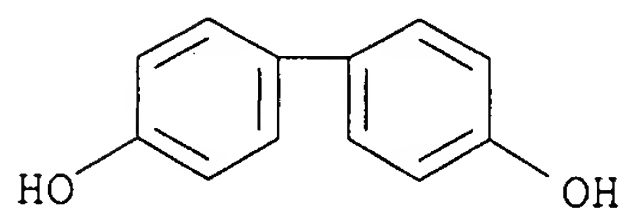


● 2 Na

CM 2

CRN 92-88-6

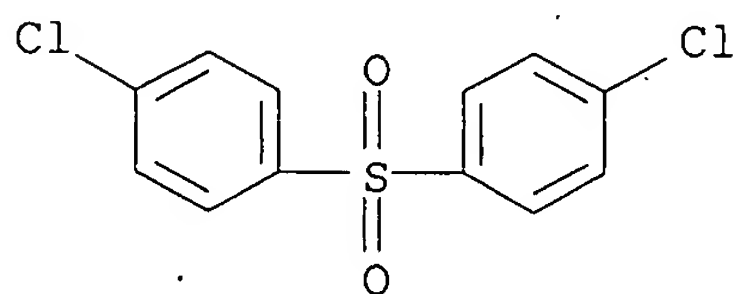
CMF C12 H10 O2



CM 3

CRN 80-07-9

CMF C12 H8 C12 O2 S



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Referenced Author (RAU)	Year (RPY)	VOL (RVL)	PG (RPG)	Referenced Work (RWK)	Referenced File
Johnson, B	1984	22	721	J Polym Sci	HCAPLUS
McGrath, J	1999			ACS Symposium	
Nolte, R	1993		83	J Memb Sci	
Savadogo, O	1998	1	66	J New Mater Electrochem	
Wang, F	2001			Macromol Symp in pre	
Wang, F	2000	41	237	Polymer Preprints	HCAPLUS
Wang, F	2001			Submitted for public	
Zaidi, S	2000	173	17	J Memb Sci	HCAPLUS

L95 ANSWER 17 OF 21 HCAPLUS COPYRIGHT 2006 ACS on STN

AN 2000:594001 HCAPLUS

DN 133:296766

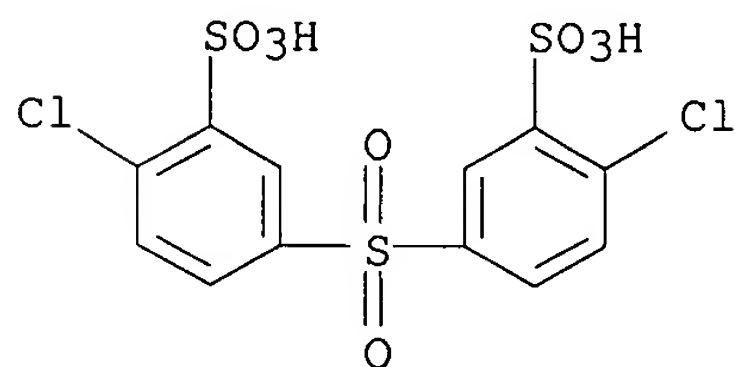
TI Synthesis and characterization of controlled molecular weight sulfonated amino-functional poly(arylene ether sulfone)s prepared by direct

polymerization  
 AU Mecham, J.; Shobha, H. K.; Wang, F.; Harrison, W.; McGrath, J. E.  
 CS Department of Chemistry and Center for High Performance Polymeric  
 Adhesives and Composites (0344), Virginia Polytechnic Institute and State  
 University, Blacksburg, VA, 24061, USA  
 SO Polymer Preprints (American Chemical Society, Division of Polymer  
 Chemistry) (2000), 41(2), 1388-1389  
 CODEN: ACPPAY; ISSN: 0032-3934  
 PB American Chemical Society, Division of Polymer Chemistry  
 DT Journal  
 LA English  
 AB Controlled mol. weight sulfonated poly(arylene ether sulfone)s were prepared by  
 direct polymerization of the sulfonated dihalide using typical polysulfone  
 polymerization conditions. Reaction temps. of 190° were needed to ensure  
 the polymer remained in solution throughout the reaction. The  
 4,4'-dichlorodiphenylsulfone (DCDPS) with fuming sulfuric acid (SO<sub>3</sub> 28%),  
 isolated with NaCl, neutralized with NaOH, and finally isolated with NaCl.  
 The electrophilic aromatic substitution reaction sulfonates DCDPS meta to the  
 sulfonyl group and ortho to the chlorine group. Polymerization involved  
 condensation of m-aminophenol with SDCDPS and biphenol in NMP, with  
 toluene as an azeotroping agent. These materials can be used as  
 macromonomers in poly(imide) segmented copolymer reactions and as proton  
 exchange membranes for fuel cells.  
 CC 35-5 (Chemistry of Synthetic High Polymers)  
 IT 591-27-5DP, m-Aminophenol, reaction products with sulfo group-containing  
 polyether-polysulfones **267877-35-0DP**, m-aminophenol end-capped  
 RL: SPN (Synthetic preparation); PREP (Preparation)  
 (preparation of sulfonated dichlorodiphenylsulfone and of controlled mol.  
 weight amino-terminated sulfonated poly(arylene ether sulfone)s)  
 IT **267877-35-0DP**, m-aminophenol end-capped  
 RL: SPN (Synthetic preparation); PREP (Preparation)  
 (preparation of sulfonated dichlorodiphenylsulfone and of controlled mol.  
 weight amino-terminated sulfonated poly(arylene ether sulfone)s)  
 RN 267877-35-0 HCAPLUS  
 CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, disodium salt, polymer  
 with [1,1'-biphenyl]-4,4'-diol and 1,1'-sulfonylbis[4-chlorobenzene] (9CI)  
 (CA INDEX NAME)

CM 1

CRN 51698-33-0

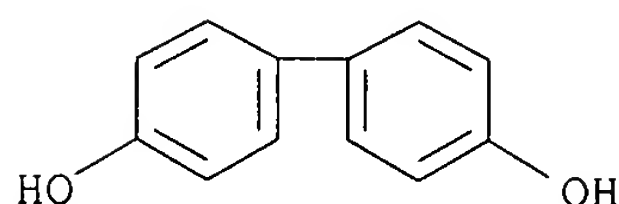
CMF C12 H8 Cl2 O8 S3 . 2 Na



● 2 Na

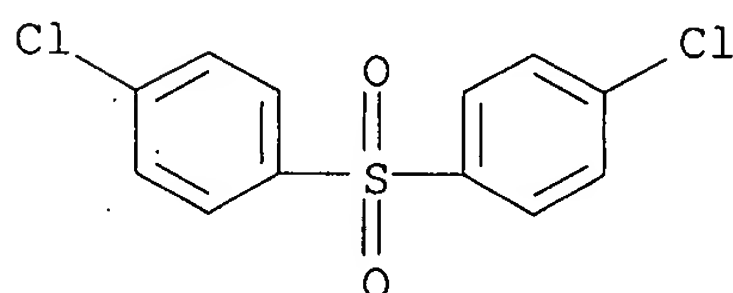
CM 2

CRN 92-88-6  
CMF C12 H10 O2



CM 3

CRN 80-07-9  
CMF C12 H8 Cl2 O2 S



# RETABLE

Referenced Author (RAU)	Year (RPY)	VOL (RVL)	PG (RPG)	Referenced Work (RWK)	Referenced File
Applby, A	1999		72	Sci American	
Dumais, J	1986	19	1884	Macromolecules	HCAPLUS
Jacoby, M	1999	31	71	C&E News	
McGrath, J	1984	22	721	J of Polym Sci	
McGrath, J	1981	153	327	Poly(aryl ether) Mem	
McGrath, J	2000	41		Polymer Preprints	
Noshay, A	1976	20	1885	J of Appl Poly Sci	HCAPLUS
Robeson, L	1978	4	405	Dynamic Mechanical C	HCAPLUS
Ueda, M	1993	31	85	J Polym Sci, Poly Ch	

L95 ANSWER 18 OF 21 HCAPLUS COPYRIGHT 2006 ACS on STN

AN 2000:208130 HCAPLUS

DN 132:334953

TI Synthesis of sulfonated poly(arylene ether sulfone)s via direct polymerization

AU Wang, F.; Ji, Q.; Harrison, W.; Mecham, J.; Formato, R.; Kovar, R.; Osenar, P.; McGrath, J. E.

CS Department of Chemistry and NSF Science and Technology Center on High Performance Polymeric Adhesives and Composites (0344), Virginia Polytechnic Institute and State University, Blacksburg, VA, 24061, USA

SO Polymer Preprints (American Chemical Society, Division of Polymer Chemistry) (2000), 41(1), 237-238

CODEN: ACPPAY; ISSN: 0032-3934

PB American Chemical Society, Division of Polymer Chemistry

DT Journal

LA English

AB 4,4'-Biphenol was copolymd. with 4,4'-dichlorodiphenyl sulfone and di-Na 3,3'-sulfonylbis(6-chlorobenzenesulfonate) at 190° to provide hydrophilic sulfonated aromatic polyether-polysulfones of intrinsic viscosity 0.73-1.3 (N-methylpyrrolidone, 25°) in 90-93% yields.

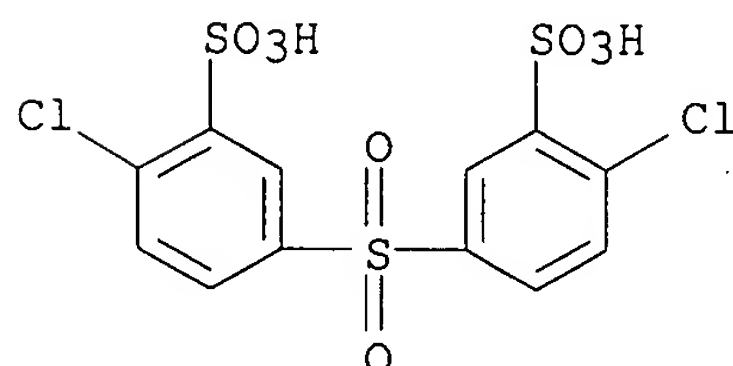
CC 35-5 (Chemistry of Synthetic High Polymers)

IT **267877-35-0P**, 4,4'-Biphenol-4,4'-dichlorodiphenyl sulfone-disodium  
 3,3'-sulfonylbis(6-chlorobenzenesulfonate) copolymer  
 RL: SPN (Synthetic preparation); PREP (Preparation)  
 (preparation of hydrophilic aromatic sulfonated polyether-polysulfones)  
 IT **267877-35-0P**, 4,4'-Biphenol-4,4'-dichlorodiphenyl sulfone-disodium  
 3,3'-sulfonylbis(6-chlorobenzenesulfonate) copolymer  
 RL: SPN (Synthetic preparation); PREP (Preparation)  
 (preparation of hydrophilic aromatic sulfonated polyether-polysulfones)  
 RN 267877-35-0 HCAPLUS  
 CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, disodium salt, polymer  
 with [1,1'-biphenyl]-4,4'-diol and 1,1'-sulfonylbis[4-chlorobenzene] (9CI)  
 (CA INDEX NAME)

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CRN 51698-33-0

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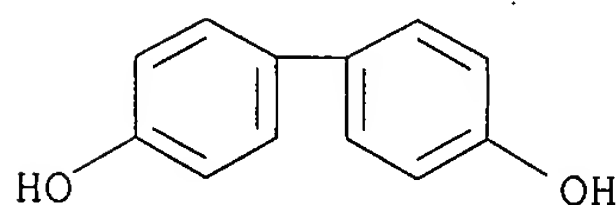


● 2 Na

CM 2

CRN 92-88-6

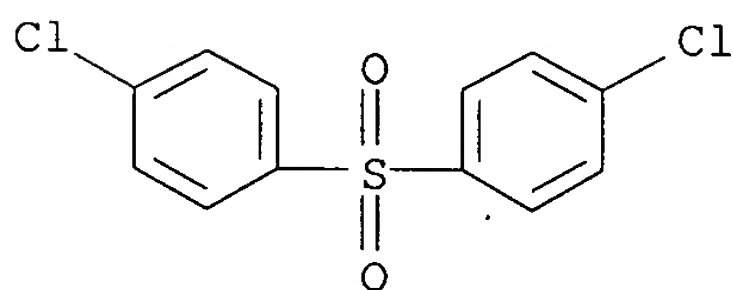
CMF C12 H10 O2



CM 3

CRN 80-07-9

CMF C12 H8 Cl2 O2 S



## RETABLE

Referenced Author (RAU)	Year (RPY)	VOL (RVL)	PG (RPG)	Referenced Work (RWK)	Referenced File
Applby, A	1999		72	Sci American	
Dumais, J	1986	19	1884	Macromolecules	HCAPLUS
Gunduz, N				this issue	
Jacoby, M	1999	77	31	C&E News	
Kovar, R				Unpublished results	
McGrath, J	1981		327	"Poly(Aryl Ether) Me	
McGrath, J	1999			"Sulfonated Poly(ary	
McGrath, J	1984	22	721	J of Polym Sci	
McGrath, J	1983	1	347	Physicochemical Aspe	
Mercier, R	1999			Fifth European Techn	
Noshay, A	1976	20	1885	J of Appl Polym Sci	HCAPLUS
Robeson, L	1983			US 4380598	HCAPLUS
Robeson, L	1978	4	405	Dynamic Mechanical C	HCAPLUS
Shobha, H				this issue	
Springer, T	1991	138	2334	Journal of the Elect	HCAPLUS
Tran, C	1980			M S thesis, "Quantit	
Udea, M	1993	31	85	J Polym Sci, Polym C	
Zhang, Y	1999	40	480	Polym Preprint	HCAPLUS

L95 ANSWER 19 OF 21 HCAPLUS COPYRIGHT 2006 ACS on STN

AN 1995:426587 HCAPLUS

DN 122:189696

TI Hydrogel gas-separation membranes with selective permeation of carbon dioxide

IN Kazama, Shingo; Kanzawa, Choji

PA Kogyo Gijutsuin, Japan; Chikyu Kankyo Sangyo Gijutsu K; Shinnippon Seitetsu KK

SO Jpn. Kokai Tokkyo Koho, 10 pp.

CODEN: JKXXAF

DT Patent

LA Japanese

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 06210145	A2	19940802	JP 1992-283486	19920930 <--
	JP 3247953	B2	20020121		
	US 5409525	A	19950425	US 1993-128098	19930929 <--
PRAI	JP 1992-283486	A	19920930	<--	

AB The title membranes contain a water- or CO2-compatible material aqueous solution

placed evenly on a support film made of solvent-so. polymers having bulky structural portion and hydrophilic functional group in the repeating unit. A polymer was prepared from 9,9-bis(4-hydroxyphenyl)fluorene, 4,4'-dichlorodiphenyl sulfone, and 4,4'-dichlorodiphenyl sulfone-3,3'-disulfonic acid, cast from a N-methyl-2-pyrrolidone solution on a glass plate, and gelled in water to give a hydrogel film with water absorption 9:1 and CO2/N2 permeation ratio 32.

IC ICM B01D0069-02

ICS B01D0071-82

ICA B01D0071-68

CC 38-3 (Plastics Fabrication and Uses)

IT **Membranes**

(hydrogel gas-separation membranes with selective permeation of carbon dioxide)

IT 161635-66-1P 161635-67-2P 161635-68-3P 161635-70-7P  
161635-71-8P

RL: DEV (Device component use); IMF (Industrial manufacture); TEM  
(Technical or engineered material use); PREP (Preparation); USES (Uses)  
(hydrogel gas-separation membranes with selective permeation of carbon  
dioxide)

IT **161635-66-1P**

RL: DEV (Device component use); IMF (Industrial manufacture); TEM  
(Technical or engineered material use); PREP (Preparation); USES (Uses)  
(hydrogel gas-separation membranes with selective permeation of carbon  
dioxide)

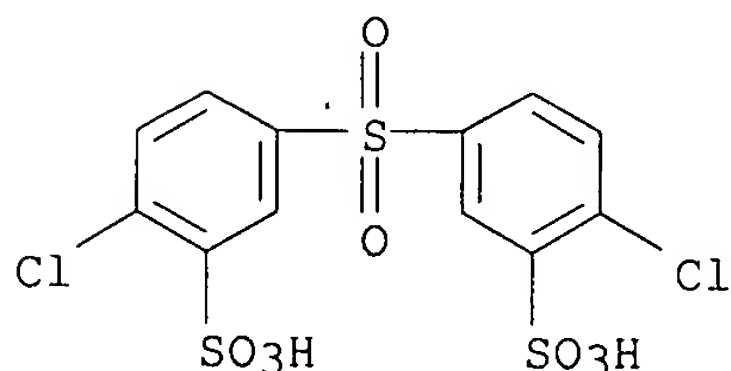
RN 161635-66-1 HCAPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, polymer with  
4,4'-(9H-fluoren-9-ylidene)bis[phenol] and 1,1'-sulfonylbis[benzene]  
dichloro deriv. (9CI) (CA INDEX NAME)

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CRN 57570-28-2

CMF C12 H8 C12 O8 S3

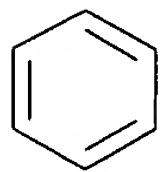


CM 2

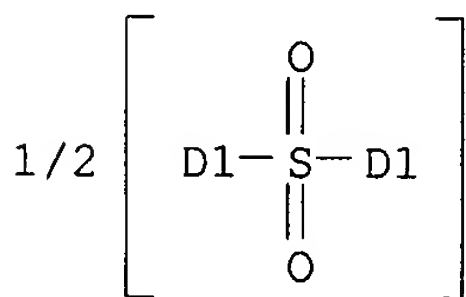
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CMF C12 H8 C12 O2 S

CCI IDS



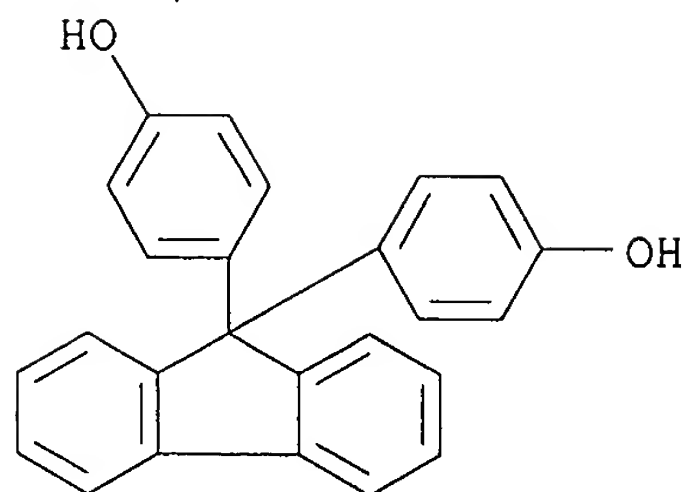
D1-C1



CM 3

CRN 3236-71-3

CMF C25 H18 O2



L95 ANSWER 20 OF 21 HCAPLUS COPYRIGHT 2006 ACS on STN

AN 1993:409381 HCAPLUS

DN 119:9381

TI heat-resistant sulfonated polysulfones

IN Harada, Yoshiyuki; Teramoto, Takeo

PA Nippon Steel Corp., Japan

SO Jpn. Kokai Tokkyo Koho, 4 pp.

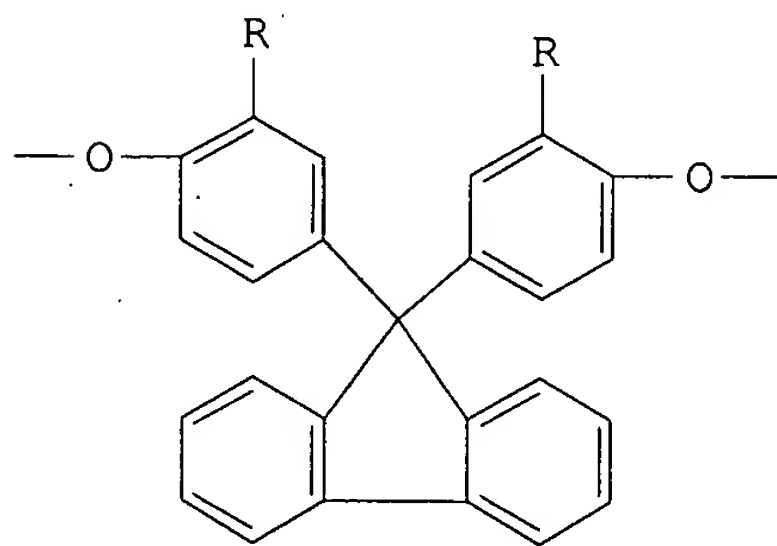
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DT Patent

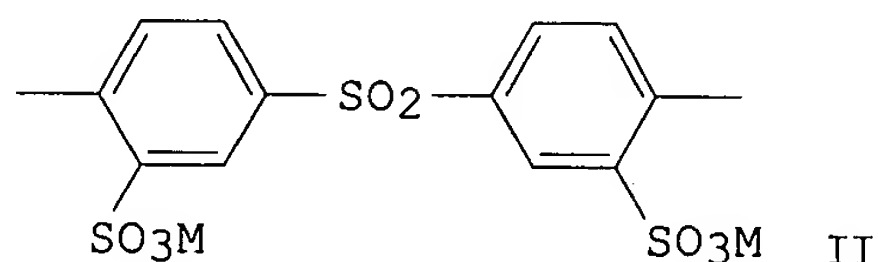
LA Japanese

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
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GI					



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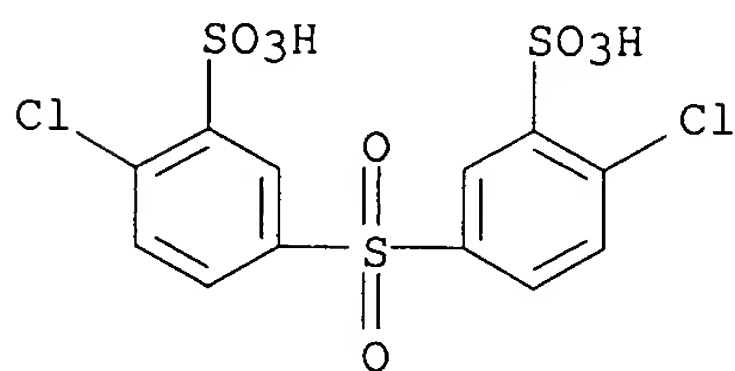


II

AB Title polysulfones with controllable sulfonation ratio and good yield, useful as materials of **ion-exchange resins** and separation **membranes**, have repeating units (XY)<sub>m</sub>(XZ)<sub>n</sub> [X = I (R = H, Me, Et); Y = -p-C<sub>6</sub>H<sub>4</sub>SO<sub>2</sub>-p-C<sub>6</sub>H<sub>4</sub>-; Z = II (M = H, alkali metal, tetraalkylammonium); m, n = repeating number; Y/Z mol ratio 99/1-1/100] and inherent viscosity 0.3-3.0. Thus, 9,9-bis(4-hydroxyphenyl)fluorene 20, 4,4'-dichlorodiphenyl sulfone 19, and di-Na 4,4'-dichlorodiphenyl sulfone-3,3'-disulfonate 1 mmol were mixed with K<sub>2</sub>CO<sub>3</sub>, dimethylacetamide, toluene, dehydrated, and treated at 120° for 15 h and at 160° for 24 h to give a sulfonated polysulfone with Y/Z mol ratio 95/5, yield 100%, inherent viscosity 0.86 dL/g, **ion-exchange** volume 0.14 meq/g, and water contact angle 69.6° (air side) and 61.5° (glass surface side).

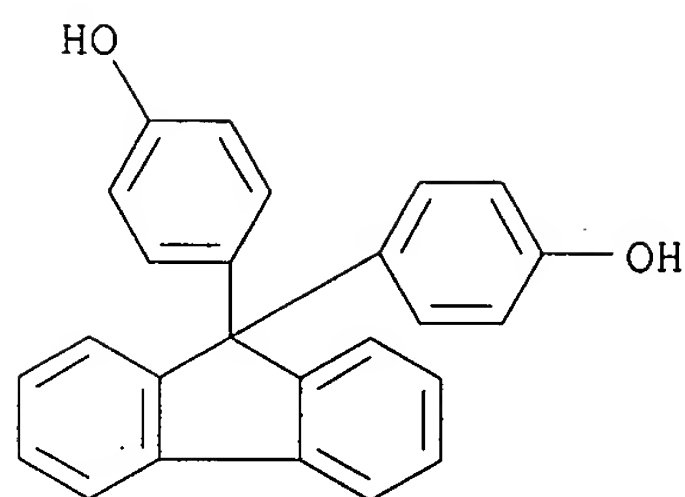


IC ICM C08G0075-20  
 CC 35-5 (Chemistry of Synthetic High Polymers)  
 Section cross-reference(s): 38  
 ST heat resistance sulfonated polysulfone; **ion exchange resin** sulfonated polysulfone; sepn **membrane** sulfonated polysulfone  
 IT **Ion exchangers**  
 (sulfonated polysulfones for, heat-resistant)  
 IT **Membranes**  
 (sulfonated polysulfones, heat-resistant)  
 IT Heat-resistant materials  
 (sulfonated polysulfones, preparation of, for **ion-exchange resins** and separation **membranes**)  
 IT Polysulfones, compounds  
 RL: PREP (Preparation)  
 (sulfonated, preparation of, heat-resistant, for **ion-exchange resins** and separation **membranes**)  
 IT **146673-89-4P**  
 RL: PREP (Preparation)  
 (preparation of, heat-resistant, for **ion-exchange resins** and separation **membranes**)  
 IT **146673-89-4P**  
 RL: PREP (Preparation)  
 (preparation of, heat-resistant, for **ion-exchange resins** and separation **membranes**)  
 RN 146673-89-4 HCAPLUS  
 CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, disodium salt, polymer with 4,4'-(9H-fluoren-9-ylidene)bis[phenol] and 1,1'-sulfonylbis[4-chlorobenzene] (9CI) (CA INDEX NAME)  
 CM 1  
 CRN 51698-33-0  
 CMF C12 H8 Cl2 O8 S3 . 2 Na



●2 Na

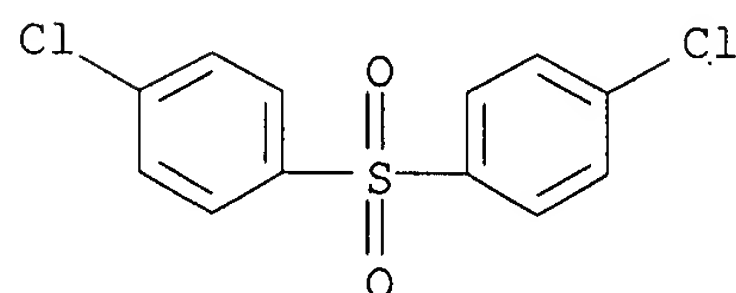
CM 2  
 CRN 3236-71-3  
 CMF C25 H18 O2



CM 3

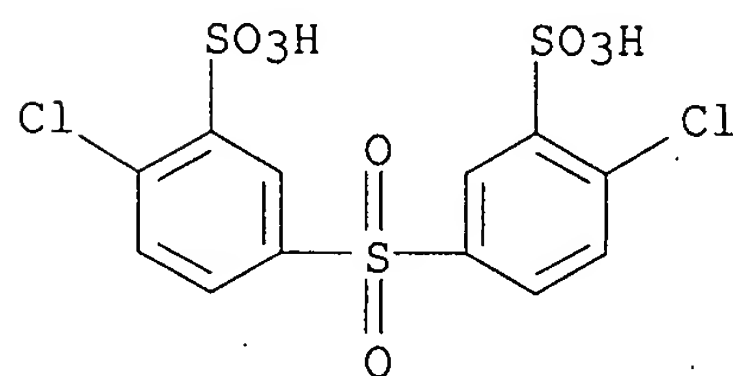
CRN 80-07-9

CMF C12 H8 C12 O2 S



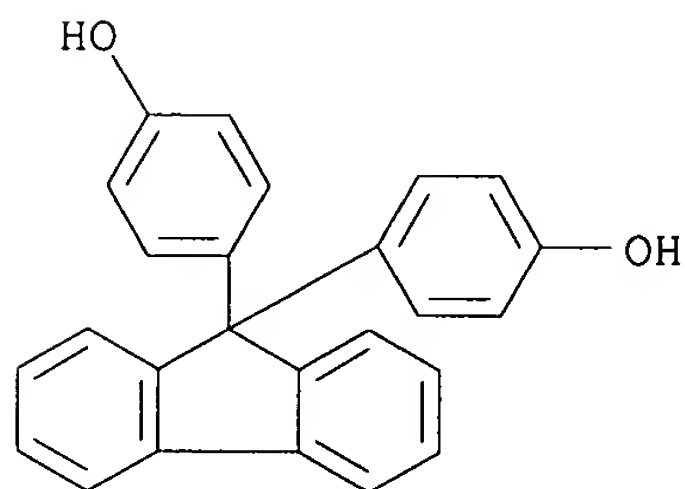
L95 ANSWER 21 OF 21 HCAPLUS COPYRIGHT 2006 ACS on STN  
 AN 1993:148174 HCAPLUS  
 DN 118:148174  
 TI Synthesis and characterization of aromatic poly(ether sulfone)s containing  
 pendent sodium sulfonate groups  
 AU Ueda, Mitsuru; Toyota, Hidetsugu; Ouchi, Takao; Sugiyama, Junichi;  
 Yonetake, Koichiro; Masuko, Toru; Teramoto, Takero  
 CS Fac. Eng., Yamagata Univ., Yonezawa, 992, Japan  
 SO Journal of Polymer Science, Part A: Polymer Chemistry (1993),  
 31(4), 853-8  
 CODEN: JPACEC; ISSN: 0887-624X  
 DT Journal  
 LA English  
 AB Poly(ether sulfones) containing pendent sodium sulfonate groups were prepared  
 by  
 the aromatic nucleophilic substitution reaction of 4,4'-  
 dichlorodiphenylsulfone (I) and sodium 5,5'-sulfonylbis(2-  
 chlorobenzenesulfonate) (II) with bisphenols in the presence of K<sub>2</sub>CO<sub>3</sub> in  
 N,N-dimethylacetamide. A new monomer containing the sodium sulfonate groups  
 was synthesized by the sulfonation of I with fuming H<sub>2</sub>SO<sub>4</sub>. The  
 polycondensation proceeded smoothly at 170° and produced the  
 desired poly(ether sulfone)s containing the Na sulfonate with inherent  
 viscosities up to 1.2 dL/g. The polymers were quite soluble in strong acid,  
 dipolar aprotic solvents, m-cresol, and dichloromethane. The  
 thermogravimetry of the polymers showed excellent thermal stability,  
 indicating that 10% weight losses of the polymers were observed in the range  
 above 460° in N atmospheric. Both the glass transition temps. and  
 hydrophilicity of the polymers increased with increasing their concns. of  
 Na sulfonate groups.  
 CC 35-5 (Chemistry of Synthetic High Polymers)  
 Section cross-reference(s): 36

IT 146673-85-0P 146673-88-3P **146673-89-4P** 146696-52-8P  
 RL: SPN (Synthetic preparation); PREP (Preparation)  
 (preparation and thermal and mech. and wetting properties of)  
 IT **146673-89-4P**  
 RL: SPN (Synthetic preparation); PREP (Preparation)  
 (preparation and thermal and mech. and wetting properties of)  
 RN 146673-89-4 HCAPLUS  
 CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, disodium salt, polymer  
 with 4,4'-(9H-fluoren-9-ylidene)bis[phenol] and 1,1'-sulfonylbis[4-  
 chlorobenzene] (9CI) (CA INDEX NAME)  
 CM 1  
 CRN 51698-33-0  
 CMF C12 H8 Cl2 O8 S3 . 2 Na

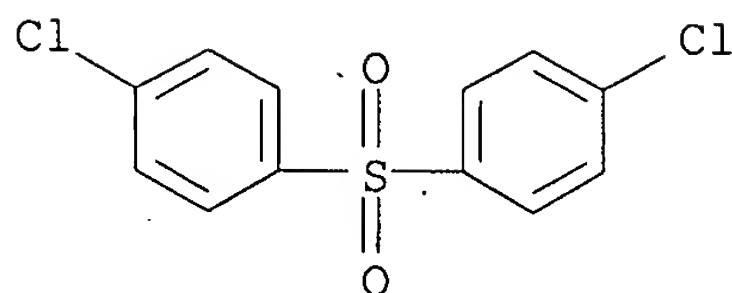


●2 Na

CM 2  
 CRN 3236-71-3  
 CMF C25 H18 O2



CM 3  
 CRN 80-07-9  
 CMF C12 H8 Cl2 O2 S



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L116 ANSWER 1 OF 2 HCAPLUS COPYRIGHT 2006 ACS on STN

AN 2003:319959 HCAPLUS

DN 138:339060

TI Crosslinkable aromatic resins having protonic acid groups, and ion conductive polymer membranes, binders, and fuel cells made by using the same

IN Ishikawa, Junichi; Kuroki, Takashi; Fujiyama, Satoko; Omi, Takehiko; Nakata, Tomoyuki; Okawa, Yuichi; Miyazaki, Kazuhisa; Fujii, Shigeharu; Tamai, Shoji

PA Mitsui Chemicals, Inc., Japan

SO PCT Int. Appl., 132 pp.

CODEN: PIXXD2

DT Patent

LA Japanese

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 2003033566	A1	20030424	WO 2002-JP10536	20021010 <--
	W: CA, CN, IN, JP, KR, US				
	RW: DE, FR, GB, IT, SE				
	TW 236486	B1	20050721	TW 2002-91123279	20021009 <--
	CA 2463429	AA	20030424	CA 2002-2463429	20021010 <--
	EP 1457511	A1	20040915	EP 2002-775319	20021010 <--
	R: DE, FR, GB, IT, SE, SI, LT, LV, RO, MK, AL				
	CN 1630676	A	20050622	CN 2002-820224	20021010 <--
	US 2004191602	A1	20040930	US 2004-820842	20040409 <--
PRAI	JP 2001-312799	A	20011010	<--	
	JP 2002-182252	A	20020621	<--	
	WO 2002-JP10536	W	20021010	<--	

AB The invention relates to (A) a crosslinkable aromatic resin which has crosslinking groups and protonic acid groups and is suitable for electrolyte membranes and binders for fuel cells, (B) polymeric electrolyte membranes and binders for fuel cells, made by using the resin, and (C) fuel cells made by using the membranes or the binders. The aromatic resin has crosslinking groups which are not derived from protonic acid groups and are capable of causing crosslinking without the formation of a leaving component, and exhibits excellent ionic conductivity, heat resistance, water resistance, and adhesion, and low methanol permeability. It is preferable that the aromatic resin bears as the crosslinking groups both Cl-10 alkyl bonded directly to an aromatic ring and carbonyl or carbon-carbon double or triple bonds, while preferred examples of the crosslinkable aromatic resin include aromatic polyether, aromatic polyamide, aromatic polyimide,

aromatic polyamide-imide, and aromatic polyazole, each of which has crosslinking

groups described above. Thus, 5,5'-carbonylbis(sodium 2-fluorobenzenesulfonate) obtained from 0.525 mol 4,4'-

difluorobenzophenone and 210 mL 50% sulfuric acid 4.22, 4,4'-difluorobenzophenone 2.18, and 2,2-bis(3,5-dimethyl-4-hydroxyphenyl)propane 5.69 g were reacted at 160° for 4 h in the presence of potassium **carbonate** to give 10.39 g polyether ketone powder with reduced viscosity 0.85 dL/g, glass transition temperature 230°, and 5% weight loss temperature 367°, which was applied on a glass and dried at 200° for 4 h to give a membrane with conductivity 0.018 S/cm at 30° and 0.065 S/cm at 90°.

IC ICM C08G0065-40

ICS C08G0069-48; C08G0073-10; C08J0005-22; H01M0008-02

CC 37-3 (Plastics Manufacture and Processing)

Section cross-reference(s): 38, 52

IT **Membranes, nonbiological**

(ionic conductive; preparation of crosslinkable aromatic resins having protonic

acid groups for ion conductive polymer membranes, binders, and fuel cells)

IT 108-31-6DP, Maleic anhydride, reaction products with protonic acid group-containing polymers 405-99-2DP, 4-Fluorostyrene, reaction products with sulfonated polymers 620-18-8DP, 3-Vinylphenol, reaction products with sulfonated polymers 1076-99-9DP, 4-Allylbenzoic acid, reaction products with protonic acid group-containing polymers 1120-71-4DP, Propanesultone, reaction products with aromatic polyether-polyketones 1745-89-7DP, reaction products with sulfonated polymers 20161-52-8DP, reaction products with sulfonated polymers 102501-86-0DP, 2-Allylphenol-2,6-dimethylphenol copolymer, sodium sulfonated 146673-88-3DP, reaction products with ethylenically unsatd. compds. 163395-54-8DP, reaction products with protonic acid group-containing polymers 210531-46-7DP, reaction products with ethenylphenol 342047-78-3DP, reaction products with ethenylphenol 342047-79-4DP, reaction products with ethenylphenol 515144-35-1P 515144-36-2P 515144-37-3P 515144-38-4P 515144-39-5P 515144-40-8P 515144-41-9P 515144-42-0P 515144-44-2DP, sulfonated 515144-45-3DP, sulfonated 515144-47-5P 515144-48-6P 515144-51-1DP, reaction products with ethenylbenzoyl chloride 515144-53-3DP, reaction products with ethenylbenzoyl chloride 515144-58-8P 515144-59-9P 515144-66-8DP, reaction products with ethenylphenol 515144-67-9DP, reaction products with ethenylphenol **515144-68-0DP**, reaction products with ethenylphenol 515144-69-1DP, reaction products with ethenylphenol 515144-70-4DP, reaction products with ethylenically unsatd. compds. 515144-71-5DP, reaction products with monoanhydride compds. 515144-72-6DP, reaction products with maleic anhydride 515144-73-7DP, reaction products with allylbenzoic acid, sulfonated 515144-74-8DP, reaction products with allylbenzoic acid, sulfonated 515144-75-9DP, reaction products with ethylenically unsatd. compds.

RL: IMF (Industrial manufacture); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

acid (crosslinked; preparation of crosslinkable aromatic resins having protonic

groups for ion conductive polymer membranes, binders, and fuel cells)

IT 24938-67-8DP, Poly(2,6-dimethyl-1,4-phenylene oxide), sodium sulfonated **267877-35-0DP**, reaction products with ethenylphenol 515144-25-9P 515144-26-0P 515144-27-1P 515144-28-2P 515144-29-3P 515144-30-6P 515144-31-7P 515144-32-8P 515144-33-9P 515144-60-2P 515144-61-3P 515144-62-4P 515144-64-6DP, sulfonated 515144-65-7DP, sulfonated 515811-98-0P

RL: IMF (Industrial manufacture); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

for (preparation of crosslinkable aromatic resins having protonic acid groups

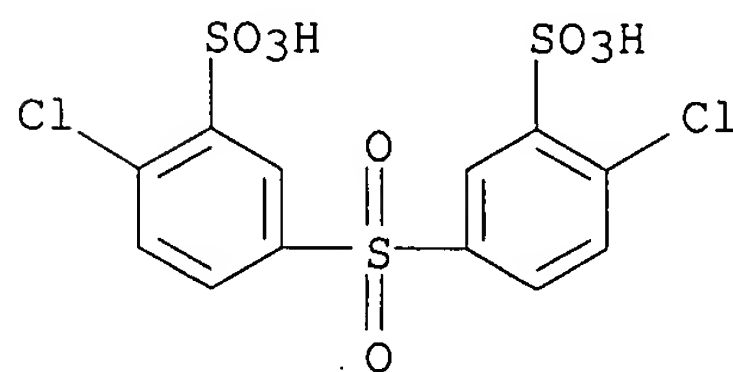
ion conductive polymer membranes, binders, and fuel cells)  
 IT 515144-68-ODP, reaction products with ethenylphenol  
 RL: IMF (Industrial manufacture); PRP (Properties); TEM (Technical or  
 engineered material use); PREP (Preparation); USES (Uses)  
 (crosslinked; preparation of crosslinkable aromatic resins having protonic  
 acid

groups for ion conductive polymer membranes, binders, and fuel cells)  
 RN 515144-68-0 HCAPLUS  
 CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, disodium salt, polymer  
 with methylenebis[phenol] and 1,1'-sulfonylbis[4-chlorobenzene] (9CI) (CA  
 INDEX NAME)

CM 1

CRN 51698-33-0

CMF C12 H8 Cl2 O8 S3 . 2 Na



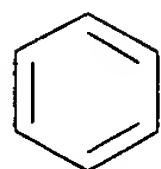
● 2 Na

CM 2

CRN 1333-16-0

CMF C13 H12 O2

CCI IDS



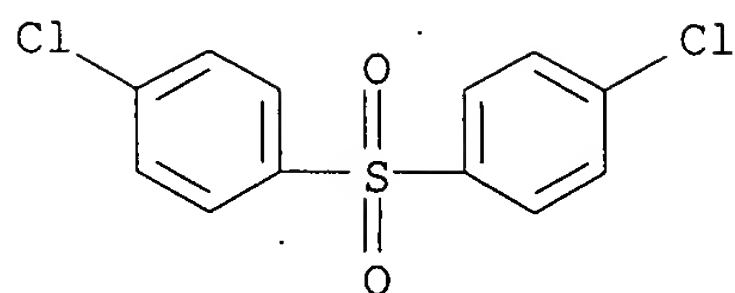
D1-OH

$\frac{1}{2} [D1-CH_2-D1]$

CM 3

CRN 80-07-9

CMF C12 H8 Cl2 O2 S



IT 267877-35-0DP, reaction products with ethenylphenol  
 RL: IMF (Industrial manufacture); PRP (Properties); TEM (Technical or  
 engineered material use); PREP (Preparation); USES (Uses)  
 (preparation of crosslinkable aromatic resins having protonic acid groups  
 for

ion conductive polymer membranes, binders, and fuel cells)

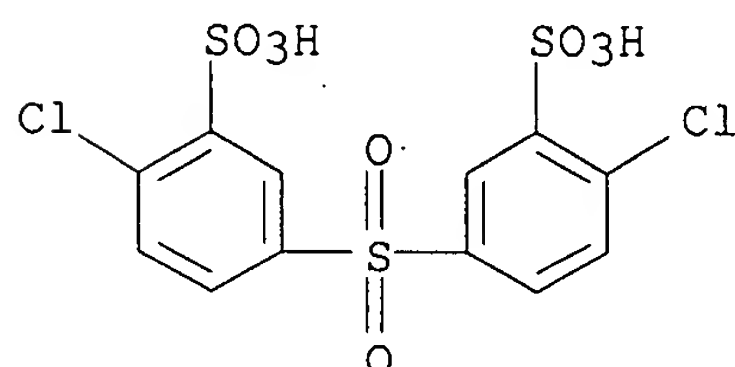
RN 267877-35-0 HCAPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, disodium salt, polymer  
 with [1,1'-biphenyl]-4,4'-diol and 1,1'-sulfonylbis[4-chlorobenzene] (9Cl)  
 (CA INDEX NAME)

CM 1

CRN 51698-33-0

CMF C12 H8 Cl2 O8 S3 . 2 Na

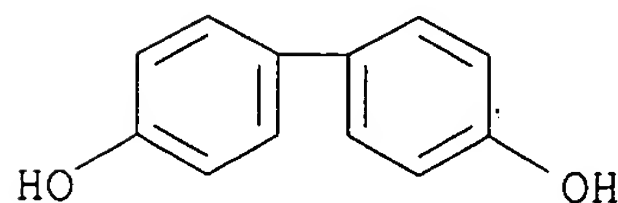


● 2 Na

CM 2

CRN 92-88-6

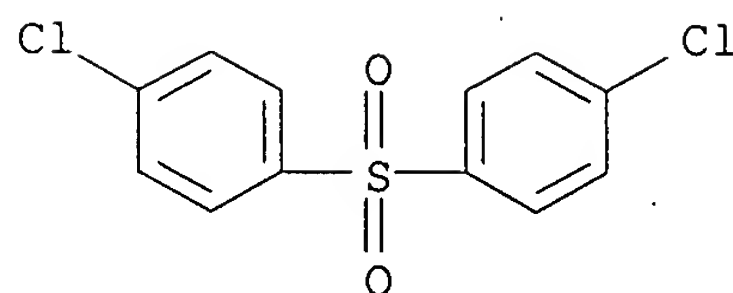
CMF C12 H10 O2



CM 3

CRN 80-07-9

CMF C12 H8 Cl2 O2 S



## RETABLE

Referenced Author (RAU)	Year (RPY)	VOL (RVL)	PG (RPG)	Referenced Work (RWK)	Referenced File
Commissariat A L'Energi	2001			WO 0125312 A	HCAPLUS
Commissariat A L'Energi	2001			JP 2000510511 A	
Commissariat A L'Energi	2001			US 200120082 A	
Commissariat A L'Energi	2001			FR 2799198 A	HCAPLUS
Hoechst Ag	1999			JP 11-502245 A	
Hoechst Ag	1999			WO 9629359 A	HCAPLUS
Kaneka Corp	2002			JP 2002105199 A	HCAPLUS
Kaneka Corp	2002			JP 2002121281 A	HCAPLUS
Sumitomo Electric Indus	2002			JP 2002358978 A	HCAPLUS
Sumitomo Electric Indus	2002			JP 2002367627 A	HCAPLUS
Victrex Manufacturing L	2000			WO 0015691 A	HCAPLUS
Victrex Manufacturing L	2000			JP 2002524631 A	

L116 ANSWER 2 OF 2 HCAPLUS COPYRIGHT 2006 ACS on STN

AN 1995:426587 HCAPLUS

DN 122:189696

TI Hydrogel gas-separation membranes with selective permeation of  
**carbon dioxide**

IN Kazama, Shingo; Kanzawa, Choji

PA Kogyo Gijutsuin, Japan; Chikyu Kankyo Sangyo Gijutsu K; Shinnippon  
Seitetsu KK

SO Jpn. Kokai Tokkyo Koho, 10 pp.

CODEN: JKXXAF

DT Patent

LA Japanese

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 06210145	A2	19940802	JP 1992-283486	19920930 <--
	JP 3247953	B2	20020121		
	US 5409525	A	19950425	US 1993-128098	19930929 <--
PRAI	JP 1992-283486	A	19920930	<--	

AB The title membranes contain a water- or CO2-compatible material aqueous  
solution

placed evenly on a support film made of solvent-so. polymers having bulky structural portion and hydrophilic functional group in the repeating unit. A polymer was prepared from 9,9-bis(4-hydroxyphenyl)fluorene, 4,4'-dichlorodiphenyl sulfone, and 4,4'-dichlorodiphenyl sulfone-3,3'-disulfonic acid, cast from a N-methyl-2-pyrrolidone solution on a glass plate, and gelled in water to give a hydrogel film with water absorption 9:1 and CO2/N2 permeation ratio 32.

IC ICM B01D0069-02

ICS B01D0071-82

ICA B01D0071-68

CC 38-3 (Plastics Fabrication and Uses)

ST polyether polysulfone selective permeable membrane; **carbon dioxide** selective permeability membrane



IT **Membranes**  
(hydrogel gas-separation membranes with selective permeation of **carbon dioxide**)

IT Polyimides, uses  
RL: DEV (Device component use); IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
(hydrogel gas-separation membranes with selective permeation of **carbon dioxide**)

IT Polysulfones, uses  
RL: DEV (Device component use); IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
(polyether-, hydrogel gas-separation membranes with selective permeation of **carbon dioxide**)

IT Polyethers, uses  
RL: DEV (Device component use); IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
(polysulfone-, hydrogel gas-separation membranes with selective permeation of **carbon dioxide**)

IT **161635-66-1P** 161635-67-2P 161635-68-3P 161635-70-7P  
161635-71-8P  
RL: DEV (Device component use); IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
(hydrogel gas-separation membranes with selective permeation of **carbon dioxide**)

IT **124-38-9P, Carbon dioxide**, preparation  
RL: PUR (Purification or recovery); PREP (Preparation)  
(hydrogel gas-separation membranes with selective permeation of **carbon dioxide**)

IT **161635-66-1P**  
RL: DEV (Device component use); IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
(hydrogel gas-separation membranes with selective permeation of **carbon dioxide**)

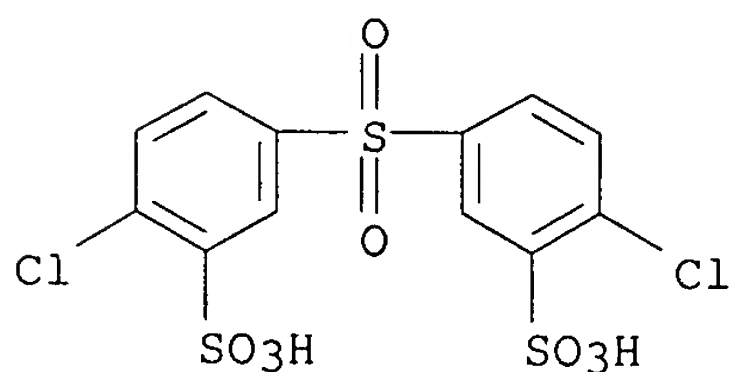
RN 161635-66-1 HCAPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, polymer with 4,4'-(9H-fluoren-9-ylidene)bis[phenol] and 1,1'-sulfonylbis[benzene] dichloro deriv. (9CI) (CA INDEX NAME)

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CRN 57570-28-2

CMF C12 H8 C12 O8 S3

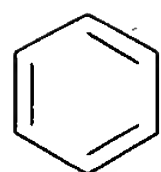


CM 2

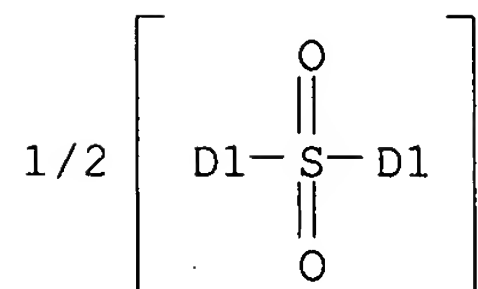
CRN 29315-80-8

CMF C12 H8 C12 O2 S

CCI IDS

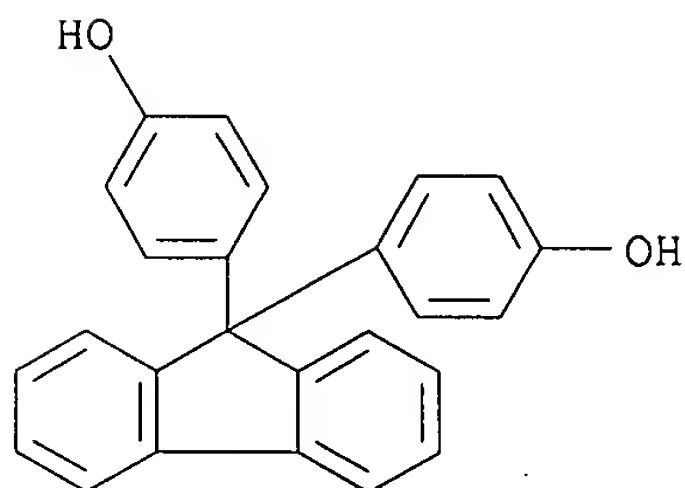


D1-Cl

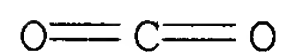


CM 3

CRN 3236-71-3  
CMF C25 H18 O2



IT 124-38-9P, Carbon dioxide, preparation  
RL: PUR (Purification or recovery); PREP (Preparation)  
(hydrogel gas-separation membranes with selective permeation of  
carbon dioxide)  
RN 124-38-9 HCAPLUS  
CN Carbon dioxide (8CI, 9CI) (CA INDEX NAME)



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(FILE 'HOME' ENTERED AT 07:47:18 ON 29 NOV 2006)  
SET COST OFF

FILE 'HCAPLUS' ENTERED AT 07:47:48 ON 29 NOV 2006

L1 1 S US20060241192/PN OR (US2005-530965# OR WO2003-JP13278 OR JP20  
SEL RN

FILE 'REGISTRY' ENTERED AT 07:49:13 ON 29 NOV 2006

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L3      STR
L4      20 S L3
L5      STR L3
L6      45 S L5
L7      STR L5
L8      2 S L7
L9      SCR 2043
L10     21 S L7 AND L9
L11     618 S L7 AND L9 FUL
        SAV TEMP L11 BERN530/A
L12     42 S L11 AND 1/NC
L13     3 S L12 AND (C24H16O10S3 OR C25H16O9S2 OR C38H24O9S2)
L14     11 S L12 AND (C27H22O10S3 OR C24H16O12S4 OR C31H30O10S3 OR C25H16O
L15     10 S L14 NOT 196301-55-0
L16     93 S L11 AND C12H10O2
L17     82 S L11 AND 92-88-6/CRN
L18     11 S L16 NOT L17
L19     10 S L18 NOT 1079-21-6/CRN
L20     92 S L17,L19
L21     57 S L11 AND C25H18O2
L22     57 S L11 AND 3236-71-3/CRN
L23     57 S L21,L22
L24     135 S L20,L23
L25     31 S L11 AND 843-55-0/CRN
L26     31 S L11 AND C18H20O2
L27     31 S L25,L26
L28     160 S L24,L27
L29     3 S L2 AND L28
L30     2 S L2 NOT L29
L31     STR
L32     0 S L31 SAM SUB=L11
L33     47 S L31 FUL SUB=L11
        SAV TEMP L33 BERN530A/A
L34     27 S L33 AND L28
L35     7 S L34 AND ((C6-C6 OR NCNCNC)/ES OR C26H16CL2O4S OR C12H8CL2O5S2
L36     20 S L34 NOT L35
L37     153 S L28,L36 NOT L35
L38     84 S L37 AND (C6H6O2 OR C13H8F2O7S2 OR C19H12F2O13S4)
L39     15 S L38 NOT 345-92-6/CRN
        SEL RN 7 8 10 11 13 14
L40     6 S E6-E11
L41     69 S L38 NOT L39
L42     5 S L41 AND 3/NC
L43     29 S L41 AND 4/NC
L44     5 S L43 AND NA/ELS
L45     35 S L41 NOT L42-L44
        SEL RN 5 14 15 24 27 30 33
L46     7 S E12-E18
L47     4 S L40 NOT (862773-05-5 OR 1478-61-1/CRN)
L48     2 S L15 AND (912548-40-4 OR 912548-38-0)
L49     69 S L37 NOT L38-L48
L50     13 S L49 AND C7H3CL2N
        SEL RN 3 4 6 7
L51     9 S L50 NOT E19-E22
L52     56 S L49 NOT L50
L53     12 S L52 AND 3/NC
        SEL RN 2 7 10 12
L54     4 S E23-E26

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L55 22 S L52 AND 4/NC  
 SEL RN 6 8 12 13 15-19 21 22  
 L56 11 S E27-E37  
 L57 22 S L52 NOT L53,L55  
 L58 50 S L13,L29,L42,L44,L46,L47,L48,L51,L54,L56  
 SAV TEMP L58 BERN530B/A  
 L59 1 S 463-79-6  
 L60 7979 S 463-79-6/CRN  
 L61 1 S L11 AND L60  
 L62 49 S L58 NOT L61

FILE 'HCAPLUS' ENTERED AT 09:01:43 ON 29 NOV 2006

L63 2 S L61  
 L64 106 S L62  
 L65 14 S L63,L64 AND L59,L60  
 L66 19 S L63,L64 AND (CARBONATE OR BICARBONATE OR CARBONIC ACID OR BIC  
 L67 21 S L65,L66  
 L68 8 S L63,L64 AND PY<=2002 NOT P/DT  
 L69 21 S L63,L64 AND (PD<=20021017 OR PRD<=20021017 OR AD<=20021017)  
 L70 7 S L68,L69 AND L67  
 L71 37 S L63,L64 AND (KITAMURA? OR SAKAGUCHI? OR NAGAHARA? OR HAMAMOTO  
 L72 40 S L63,L64 AND (TOYO? OR BOSEKI? OR KABUSHIKI?)/PA,CS  
 L73 5 S L71,L72 AND L68,L69  
 L74 10 S L70,L73  
 L75 11 S L68,L69 NOT L74  
 L76 4 S L74 AND (ION(L)EXCHANG?(L) (MEMBRAN? OR RESIN? OR COMPOSITION  
 L77 4 S L75 AND (ION(L)EXCHANG?(L) (MEMBRAN? OR RESIN? OR COMPOSITION  
 L78 8 S L76,L77  
 L79 13 S L74,L75 NOT L78  
 L80 3 S L79 AND L71,L72  
 L81 11 S L78,L80  
 L82 10 S L74,L75 NOT L81  
 SEL AN DN 5 7-10  
 L83 5 S L82 NOT E38-E52  
 L84 16 S L81,L83  
 L85 5 S L74,L75 NOT L84  
 E ION EXCHANGE/CT  
 E E3+ALL  
 L86 26135 S E3+NT  
 L87 8009 S E11+OLD,NT OR E12+OLD,NT  
 E E13+ALL  
 L88 45068 S E4,E5,E13,E16,E17,E18,E21-E23,E25  
 L89 4 S L68,L69 AND L86-L88  
 E MEMBRANE/CT  
 E E3+ALL  
 L90 43734 S E1  
 E E2+ALL  
 L91 118206 S E3+OLD OR E15-E21  
 L92 11 S L68,L69 AND L90,L91  
 L93 17 S L84,L89,L92  
 L94 4 S L69,L69 NOT L93  
 L95 21 S L93,L94 AND L1,L63-L94

FILE 'REGISTRY' ENTERED AT 09:17:56 ON 29 NOV 2006

FILE 'HCAPLUS' ENTERED AT 09:18:05 ON 29 NOV 2006

L96 56 S L71,L72,L95

FILE 'REGISTRY' ENTERED AT 09:20:02 ON 29 NOV 2006

FILE 'HCAPLUS' ENTERED AT 09:20:03 ON 29 NOV 2006

L97 TRA L96 1- RN : 263 TERMS

FILE 'REGISTRY' ENTERED AT 09:20:03 ON 29 NOV 2006

L98 263 SEA L97  
 L99 125 S L98 AND L11  
 L100 99 S L99 NOT L61,L62  
 L101 3 S L98 AND L59,L60  
 L102 18 S L100 AND C15H10F6O2  
 L103 81 S L100 NOT L102  
 L104 75 S L103 NOT C6-C6/ES  
 L105 34 S L104 NOT 345-92-6/CRN  
 L106 1 S 515144-68-0  
 L107 136 S L98 NOT L99-L106  
 L108 87 S L107 AND PMS/CI  
 L109 45 S L108 AND S/ELS  
 L110 1 S CARBONIC ACID ANHYDRIDE/CN  
 L111 1 S L98 AND L110

FILE 'HCAPLUS' ENTERED AT 09:34:07 ON 29 NOV 2006

L112 1 S L106  
 L113 3 S L110,L111,L101 AND L95  
 L114 1 S L113 AND CARBON DIOXIDE  
 L115 2 S L112,L114  
 L116 2 S L115 AND L95  
 L117 2 S L112-L115 NOT L116

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=> fil hcaplus

FILE 'HCAPLUS' ENTERED AT 10:02:47 ON 29 NOV 2006

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FILE COVERS 1907 - 29 Nov 2006 VOL 145 ISS 23

FILE LAST UPDATED: 27 Nov 2006 (20061127/ED)

New CAS Information Use Policies, enter HELP USAGETERMS for details.

This file contains CAS Registry Numbers for easy and accurate substance identification.

=> d l15 bib abs hitstr retable tot

L15 ANSWER 1 OF 4 HCAPLUS COPYRIGHT 2006 ACS on STN

AN 2004:355275 HCAPLUS

DN 140:376230

TI Composite ion exchanger membrane

IN Kitamura, Kota; Sakaguchi, Yoshimitsu; Nagahara, Shiro; Takimoto, Naohiko; Sugihara, Hideki; Takase, Tooru; Saito, Miyako

PA Toyo Boseki Kabushiki Kaisha, Japan

SO PCT Int. Appl., 92 pp.

CODEN: PIXXD2

DT Patent

LA Japanese

FAN.CNT 1

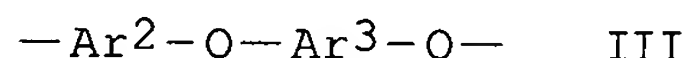
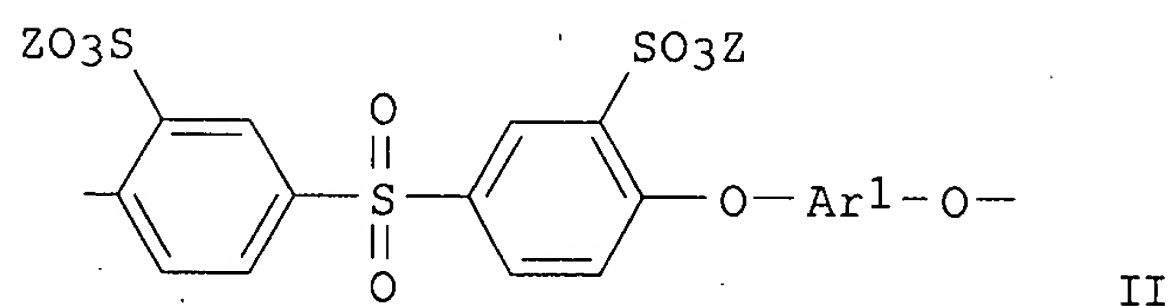
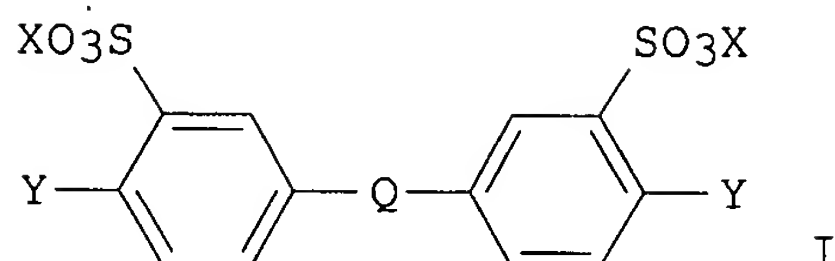
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PI	WO 2004036679	A1	20040429	WO 2003-JP13278	20031016
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	RW: GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR, BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG				
	JP 2004139836	A2	20040513	JP 2002-303289	20021017
	JP 2004139837	A2	20040513	JP 2002-303290	20021017
	JP 2004143388	A2	20040520	JP 2002-312837	20021028
	JP 2004169003	A2	20040617	JP 2003-355364	20031015
	AU 2003273034	A1	20040504	AU 2003-273034	20031016
	US 2006241192	A1	20061026	US 2005-530965	20050411
PRAI	JP 2002-303289	A	20021017		

LEXIS-NEXIS  
www.lexis-nexis.com

*This section  
contains Compds  
from claims 9, 10  
(as close as I  
can get)*

JP 2002-303290	A	20021017
JP 2002-312837	A	20021028
JP 2002-313025	A	20021028
WO 2003-JP13278	W	20031016

GI



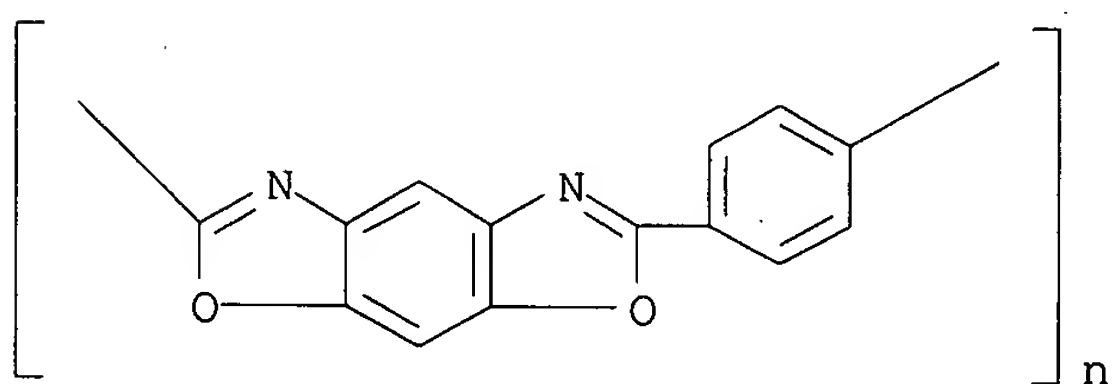
AB The membrane has ion exchanger resin in the continuous through holes in a support membrane, where the ion exchanger resin contains an aromatic ether and/or its derivative, formed by polymerization of mixture containing monomers I (Q = -SO<sub>2</sub>- or -CO-, X = H, Li, Na, or K, Y = F, Cl, Br, or I), aromatic dihalides, and bisphenol compound and alkali metal (bi)carbonate. The ion exchange resin contain 0-1000 structural units II (Z = H, Li, Na, K, or cation derived. from aliphatic or aromatic amines; Ar<sup>1</sup> and Ar<sup>3</sup> = bivalent organic groups, Ar<sup>2</sup> = bivalent organic groups containing ≥1 arom ring having electron attracting group) and 0-1000 structural units III. The composite membrane may be used as fuel cell electrolyte.

IT 60871-72-9

RL: TEM (Technical or engineered material use); USES (Uses)  
(composite membranes containing ion exchanger resins in porous polymer support membranes for fuel cell electrolytes)

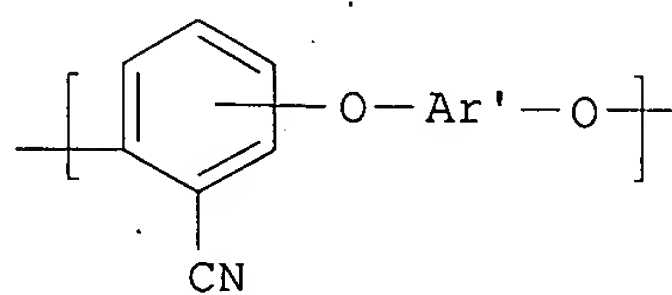
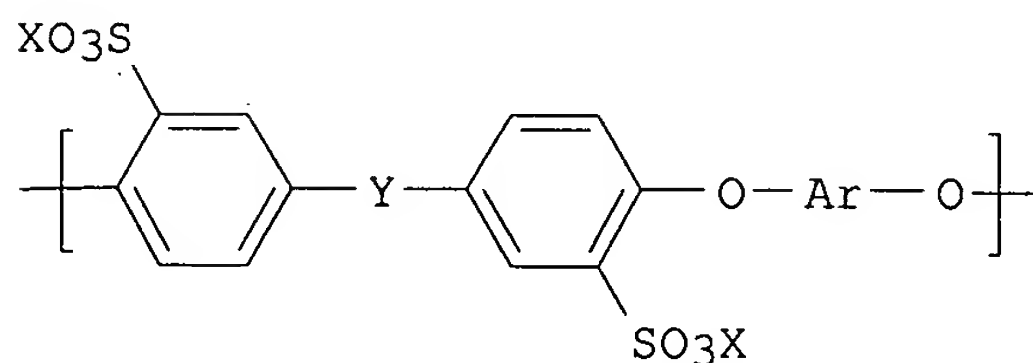
RN 60871-72-9 HCAPLUS

CN Poly(benzo[1,2-d:5,4-d']bisoxazole-2,6-diyl-1,4-phenylene) (9CI) (CA INDEX NAME)



L15 ANSWER 2 OF 4 HCAPLUS COPYRIGHT 2006 ACS on STN  
 AN 2004:333769 HCAPLUS  
 DN 140:340474  
 TI Polyarylene ether compounds containing sulfonic acid groups, their  
 compositions and manufacture method  
 IN Sakaguchi, Yoshimitsu; Kitamura, Kota; Nagahara, Shigenori; Yamashita,  
 Masahiro; Nakao, Junko  
 PA Toyo Boseki Kabushiki Kaisha, Japan  
 SO PCT Int. Appl., 75 pp.  
 CODEN: PIXXD2  
 DT Patent  
 LA Japanese  
 FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 2004033534	A1	20040422	WO 2003-JP12850	20031007
	W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, KE, KG, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW				
	RW: GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR, BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG				
	JP 2004244437	A2	20040902	JP 2003-32622	20030210
	AU 2003268784	A1	20040504	AU 2003-268784	20031007
	JP 2004149779	A2	20040527	JP 2003-348477	20031007
	EP 1561768	A1	20050810	EP 2003-748749	20031007
	R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO, MK, CY, AL, TR, BG, CZ, EE, HU, SK				
	CN 1703443	A	20051130	CN 2003-80100996	20031007
	JP 2004263167	A2	20040924	JP 2003-367183	20031028
	US 2006166048	A1	20060727	US 2005-530199	20050404
PRAI	JP 2002-295284	A	20021008		
	JP 2003-32621	A	20030210		
	JP 2003-32622	A	20030210		
	WO 2003-JP12850	W	20031007		
GI					





AB The title polymers, showing good ion conductivity and heat resistance, comprise the units of I and II (Ar, Ar' = divalent aromatic group; X = H, monovalent cation; Y = SO<sub>2</sub>, CO). The polymers and their compns. containing polybenzimidazoles are useful for ion-conductive films, electrolytes, fuel cells, and adhesives. Thus, a 1:0.38:0.62 (mol) 4,4'-biphenol-3,3'-disulfo-4,4'-dichlorodiphenylsulfone disodium salt-2,6-dichlorobenzonitrile copolymer was prepared and made into a film showing 3%-weight loss temperature 380° and ion conductivity 0.14 S/cm.

IT **426255-33-6P**

RL: IMF (Industrial manufacture); POF (Polymer in formulation); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

(heat-resistant sulfo-containing polyethers for ion-conductive films)

RN 426255-33-6 HCAPLUS

CN Poly[1H-benzimidazole-2,5-diylsulfonyl-1H-benzimidazole-5,2-diyl(sulfo-1,4-phenylene) monosodium salt] (9CI) (CA INDEX NAME)

\*\*\* STRUCTURE DIAGRAM IS NOT AVAILABLE \*\*\*

RETABLE

Referenced Author (RAU)	Year (RPY)	VOL (RVL)	PG (RPG)	Referenced Work (RWK)	Referenced File
Foster-Miller Inc	1999			JP 2003503510 A	
Foster-Miller Inc	1999			WO 99010165 A	
Honda Motor Co Ltd	2002			JP 2002367629 A	HCAPLUS
Jsr Corp	2002			JP 2002220530 A	HCAPLUS
Toyobo Co Ltd	2003			JP 2003012795 A	HCAPLUS
Toyobo Co Ltd	2003			JP 2003217342 A	HCAPLUS

L15 ANSWER 3 OF 4 HCAPLUS COPYRIGHT 2006 ACS on STN

AN 2003:907123 HCAPLUS

DN **139:382455**

TI Compositions containing acidic group-containing polybenzimidazoles and acidic group-containing polymers for adhesives and ion conductor membranes used in electrode composites of fuel cells

IN Sakaguchi, Yoshimitsu; Kitamura, Kota; Nagahara, Shigenori

PA Toyobo Co., Ltd., Japan

SO Jpn. Kokai Tokkyo Koho, 14 pp.

CODEN: JKXXAF

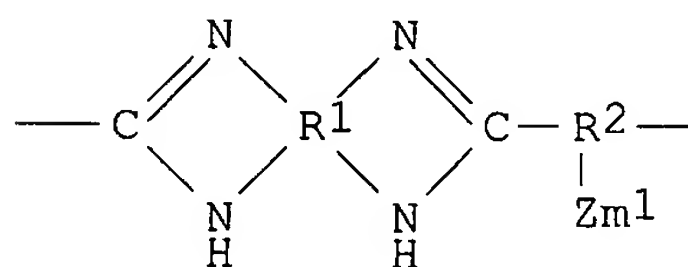
DT Patent

LA Japanese

FAN.CNT 1

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 2003327825	A2	20031119	JP 2002-133112	20020508
PRAI JP 2002-133112		20020508		

GI



I

AB The compns. giving polymer electrolyte membranes with high ion conductivity while

suppressing swelling in high-temperature humid state, comprise polybenzimidazoles having structural components I (m1 = 1-4; R1 = imidazole ring-forming tetravalent aromatic linkage; R2 = divalent aromatic linkage; R1 and R2 may be single aromatic ring or linked residue or condensed ring of plural aromatic rings optionally with stable substituent; Z = sulfonic acid and/or phosphonic acid residue optionally with partial salt structure) and acidic group-containing polymers. Thus, a solution of polybenzimidazole prepared from 3,3',4,4'-tetraaminodiphenylsulfone and 2,5-dicarboxybenzenesulfonic acid monosodium salt was mixed with a solution of sulfonated 9,9-bis(4-hydroxyphenyl)fluorene-bis(4-hydroxyphenyl)sulfone-4,4'-difluorodiphenylsulfone copolymer to give a mixture, which was processed to give a film showing ion conductivity (80°, 95%RH) 0.07 S/cm.

IT 426255-33-6P

RL: IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

(comps. containing acidic group-containing polybenzimidazoles and acidic group-containing polymers for fuel cell ion conductor membranes and adhesives)

RN 426255-33-6 HCAPLUS

CN Poly[1H-benzimidazole-2,5-diylsulfonyl-1H-benzimidazole-5,2-diyl(sulfo-1,4-phenylene) monosodium salt] (9CI) (CA INDEX NAME)

\*\*\* STRUCTURE DIAGRAM IS NOT AVAILABLE \*\*\*

L15 ANSWER 4 OF 4 HCAPLUS COPYRIGHT 2006 ACS on STN

AN 2003:319959 HCAPLUS

DN 138:339060

TI **Crosslinkable** aromatic resins having protonic acid groups, and ion conductive polymer membranes, binders, and fuel cells made by using the same

IN Ishikawa, Junichi; Kuroki, Takashi; Fujiyama, Satoko; Omi, Takehiko; Nakata, Tomoyuki; Okawa, Yuichi; Miyazaki, Kazuhisa; Fujii, Shigeharu; Tamai, Shoji

PA Mitsui Chemicals, Inc., Japan

SO PCT Int. Appl., 132 pp.

CODEN: PIXXD2

DT Patent

LA Japanese

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 2003033566	A1	20030424	WO 2002-JP10536	20021010
	W: CA, CN, IN, JP, KR, US				
	RW: DE, FR, GB, IT, SE				
	TW 236486	B1	20050721	TW 2002-91123279	20021009
	CA 2463429	AA	20030424	CA 2002-2463429	20021010
	EP 1457511	A1	20040915	EP 2002-775319	20021010
	R: DE, FR, GB, IT, SE, SI, LT, LV, RO, MK, AL				
	CN 1630676	A	20050622	CN 2002-820224	20021010
	US 2004191602	A1	20040930	US 2004-820842	20040409
PRAI	JP 2001-312799	A	20011010		
	JP 2002-182252	A	20020621		
	WO 2002-JP10536	W	20021010		

AB The invention relates to (A) a **crosslinkable** aromatic resin which has **crosslinking** groups and protonic acid groups and is suitable for electrolyte membranes and binders for fuel cells, (B) polymeric electrolyte membranes and binders for fuel cells, made by using the resin, and (C) fuel cells made by using the membranes or the binders. The aromatic resin has **crosslinking** groups which are not derived from protonic acid groups and are capable of causing **crosslinking**

without the formation of a leaving component, and exhibits excellent ionic conductivity, heat resistance, water resistance, and adhesion, and low methanol permeability. It is preferable that the aromatic resin bears as the **crosslinking** groups both C1-10 alkyl bonded directly to an aromatic ring and carbonyl or carbon-carbon double or triple bonds, while preferred examples of the **crosslinkable** aromatic resin include aromatic polyether, aromatic polyamide, aromatic polyimide, aromatic polyamide-imide,

and

aromatic polyazole, each of which has **crosslinking** groups described above. Thus, 5,5'-carbonylbis(sodium 2-fluorobenzenesulfonate) obtained from 0.525 mol 4,4'-difluorobenzophenone and 210 mL 50% sulfuric acid 4.22, 4,4'-difluorobenzophenone 2.18, and 2,2-bis(3,5-dimethyl-4-hydroxyphenyl)propane 5.69 g were reacted at 160° for 4 h in the presence of potassium carbonate to give 10.39 g polyether ketone powder with reduced viscosity 0.85 dL/g, glass transition temperature 230°, and 5% weight loss temperature 367°, which was applied on a glass and dried at 200° for 4 h to give a membrane with conductivity 0.018 S/cm at 30° and 0.065 S/cm at 90°.

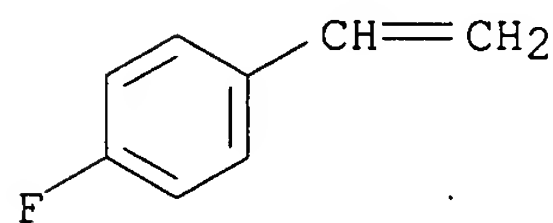
IT 405-99-2DP, 4-Fluorostyrene, reaction products with sulfonated polymers 515144-74-8DP, reaction products with allylbenzoic acid, sulfonated

RL: IMF (Industrial manufacture); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

(**crosslinked**; preparation of **crosslinkable** aromatic resins having protonic acid groups for ion conductive polymer membranes, binders, and fuel cells)

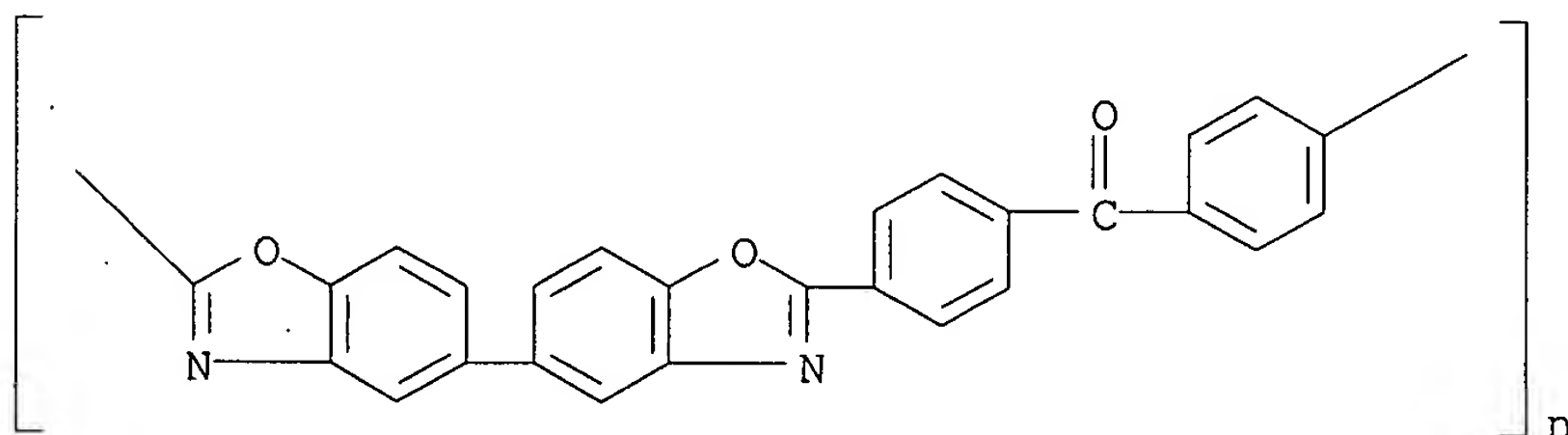
RN 405-99-2 HCAPLUS

CN Benzene, 1-ethenyl-4-fluoro- (9CI) (CA INDEX NAME)



RN 515144-74-8 HCAPLUS

CN Poly([5,5'-bibenzoxazole]-2,2'-diyl-1,4-phenylenecarbonyl-1,4-phenylene) (9CI) (CA INDEX NAME)



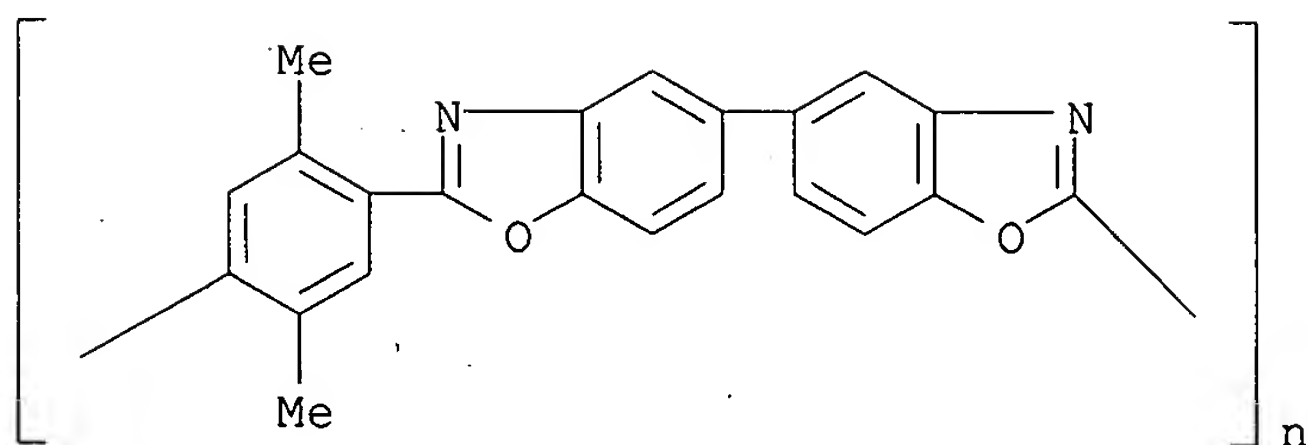
IT 515144-65-7DP, sulfonated

RL: IMF (Industrial manufacture); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

(preparation of **crosslinkable** aromatic resins having protonic acid groups for ion conductive polymer membranes, binders, and fuel cells)

RN 515144-65-7 HCAPLUS

CN Poly([5,5'-bibenzoxazole]-2,2'-diyl(2,5-dimethyl-1,4-phenylene)) (9CI) (CA INDEX NAME)



RETABLE

Referenced Author (RAU)	Year (RPY)	VOL (RVL)	PG (RPG)	Referenced Work (RWK)	Referenced File
Commissariat A L'Energi	2001			WO 0125312 A	HCAPLUS
Commissariat A L'Energi	2001			JP 2000510511 A	
Commissariat A L'Energi	2001			US 200120082 A	
Commissariat A L'Energi	2001			FR 2799198 A	HCAPLUS
Hoechst Ag	1999			JP 11-502245 A	
Hoechst Ag	1999			WO 9629359 A	HCAPLUS
Kaneka Corp	2002			JP 2002105199 A	HCAPLUS
Kaneka Corp	2002			JP 2002121281 A	HCAPLUS
Sumitomo Electric Indus	2002			JP 2002358978 A	HCAPLUS
Sumitomo Electric Indus	2002			JP 2002367627 A	HCAPLUS
Victrex Manufacturing L	2000			WO 0015691 A	HCAPLUS
Victrex Manufacturing L	2000			JP 2002524631 A	

=> d his

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SET COST OFF

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L1 5 S (140:376230 OR 140:340474 OR 139:382455 OR 139:152288 OR 138:  
SEL RN

FILE 'REGISTRY' ENTERED AT 09:47:39 ON 29 NOV 2006

L2 27 S E1-E27  
L3 2 S L2 AND (C14H6N2O2 OR C20H12N4O5S2)

FILE 'HCAPLUS' ENTERED AT 09:49:38 ON 29 NOV 2006

L4 16 S (143:406557 OR 143:232667 OR 140:409658 OR 139:396487 OR 138:

FILE 'REGISTRY' ENTERED AT 09:55:25 ON 29 NOV 2006

FILE 'HCAPLUS' ENTERED AT 09:55:25 ON 29 NOV 2006  
L5 TRA L4 1- RN : 172 TERMS

FILE 'REGISTRY' ENTERED AT 09:55:26 ON 29 NOV 2006

L6 172 SEA L5  
ACT BERN530/A

L7 STR  
L8 SCR 2043  
L9 618 SEA FILE=REGISTRY SSS FUL L7 AND L8

L10 95 S L6 NOT L9  
 L11 3 S L10 AND (C8H7F OR C27H14N2O3 OR C22H14N2O2)  
 L12 5 S L3,L11

FILE 'HCAPLUS' ENTERED AT 10:01:50 ON 29 NOV 2006

L13 4 S L12 AND L1,L4  
 L14 1 S L13 AND (?CROSSLINK? OR ?CROSS LINK?)  
 L15 4 S L13,L14

FILE 'HCAPLUS' ENTERED AT 10:02:47 ON 29 NOV 2006

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